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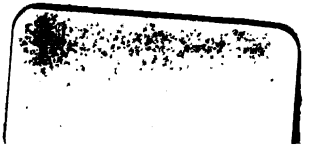

THE

MINER'S GUIDE,

BEING

A DESCRIPTION AND ILLUSTRATION

OF

A CHART OF SECTIONS

OF THE

PRINCIPAL MINES OF COAL AND IRONSTONE

IN THE COUNTIES OF

STAFFORD, SALOP, WARWICK, AND DURHAM.

BY

THOMAS SMITH,

MINE AND LAND AGENT,

SANDY-FIELDS, NEAR SEDGLEY.

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1836.

242.

TO

JAMES FOSTER, ESQ.

OF

STOURTON CASTLE, IN THE COUNTY OF STAFFORD,

IRON MASTER;

THIS VOLUME

AND

THE ACCOMPANYING CHART,

ARE RESPECTFULLY DEDICATED

BY

HIS OBEDIENT AND OBLIGED SERVANT,

THOMAS SMITH.

Sandy-Fields, near Sedgley,
July 1, 1836.

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PREFACE.

AMONG the various sources of the wealth and prosperity of this country ;—the causes of its elevation to the rank it holds in the scale of nations ;—its mineral productions may claim to stand prominently forward in estimation and in importance, as, in an especial manner, the parents and originators of its manufactures and its mechanical arts, and as affording a constant fund of useful and productive labour to vast masses of its population.

Much attention has latterly been directed to subjects connected with these valuable stores, deposited by the hand of nature, beneath the soil of Britain ; but the works in which they have been enumerated, classified, and described, are scientific rather than practical ;—have treated on geology rather than on mining. Conceding, to the full, the importance of geological science, as the teacher and director of the operations of mining, yet it is, in truth, the miner who furnishes to the geologist, his data,—it is the eager speculator, assisted by the industrious labourer, who lays open the secrets of the earth, and enables the man of science to form and arrange his theory, or when formed lends him the valuable aid of proof; and it has been to many, a matter of astonishment that works have not appeared, practically describing the mining operations of particular districts, and giving in detail various useful particulars as to the depth, posi-

tion, thickness, and average productiveness of each stratum, with the mode and expense of excavation; all which are so important, and so necessary to be known by persons possessing mining property, or engaged in conducting the operations dependant on such property.

Such considerations as these, added to the strongly expressed wishes of several judicious friends, have induced the Author, at the close of a life, devoted from an early age to active employment connected with the mines of North and South Staffordshire and Warwickshire, from the mass of memoranda and recorded observation which he has accumulated, to compile the present Work, and the elaborate Chart or Table of Sections which it is especially intended to accompany and illustrate. The aim has been, to exhibit a complete view of the stratification of the coal and ironstone mines in different localities, in those districts with which the author has been most conversant, together with a more brief notice of some of the principal distant coal-fields; with full statements of the cost of getting, with the various collateral expenses attendant thereon; calculations of royalty, profit, and value per acre;—the range of information extending with more or less precise detail over the mines of South Staffordshire, North Staffordshire, Shropshire, and Warwickshire, with a less detailed account of those of Lancashire and Durham.

The execution of such a work necessarily involved great research and close observation of facts, and the attention given to the execution of it has been minute and unwearied. The calculations of the production of the coal and ironstone per yard and per acre, have been made

with the greatest care, and the best voucher for their correctness is the circumstance that the author has had frequent facilities of access to, or has been directly or indirectly concerned in the working of nearly all the mines he has selected for his chart, and which he has particularly described in this volume. Indeed it has been his wish to claim for his work the character of General Guide or Directory, and to inspire confidence by a display of the resources of the country, and at the same time by a minute description of the faults and other interruptions, pointing out the varying and uncertain value of mining property, and the great necessity which exists for caution in relation to mining undertakings.

In the descriptive portion of the work, the most unreserved information is offered as to the modes of extracting the different strata, displaying according to the most approved practice, the manner of opening the pits, and of driving the various excavations, under the technical denomination of gate roads, levels, and waggon roads, by which access is obtained to every part of the mine in succession, and the most practicable means secured, of removing the produce, drawing it up to the surface, by means of the engine, and of conveying it to the point at which it is to be deposited, in readiness for land or water carriage.

In all these details, reference is made to the expense of executing each species of the required labour, including the arrangement of the pits, pumps, and engines; so as to render the work practically useful in every possible way. Mankind at large have a claim on each one, if the opportunity and means be afforded to him, to ren-

der available to public benefit, the share and degree of knowledge and experience he may possess; and when the utility and importance of the mineral treasures of a country are considered, and proper regard had to the large proportion of the population of the various mining districts, who are actively or otherwise engaged and interested in raising these stores from their hidden recesses, and rendering them available for the service of man, it cannot be thought a trivial object when an individual, the pursuits and employments of whose life have been such as to give him experience and information, records and presents to the world the result of his long observation and careful inquiry; thus, as far as is in his power, removing or lessening the difficulties that still exist, and serving the cause of humanity by preventing or abating, in some degree, the personal hazard and the probability of pecuniary loss to those who are occupied in pursuits connected with mining in its various branches.

In the literary department of his work, the Author has a debt of candour to pay to the public. Those who know him most intimately, are aware, that, though he would yield to none in diligence and in accuracy of research,—yet his own habits have scarcely qualified him for the labour of completely arranging the mass of materials he had accumulated. He, therefore, does not hesitate to avow, that his work owes much of its connected and regular form, to the care of the gentleman in whose

hands the manuscripts were placed for revision, and who fortunately possessed a certain degree of local knowledge which has enabled him to enliven the technical details with accurate and graphic descriptions;—and to intersperse brief and unpretending, but it is hoped, not mistaken notices of *geological* facts and observations,—to an extent, which scarcely came within the scope of the Author's original intention, but which, he trusts, will render the work more extensively acceptable.

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INTRODUCTORY
GEOLOGICAL SKETCH.

THOSE whose avocations or inquiries induce them to examine any portion of the earth, in reference to its mineral productions, cannot fail to be struck with appearances, everywhere presenting themselves, which indicate that the present position of the various beds or layers of earths, rocks, coal, and metallic ores, which are successively reached by the miner, or brought to view in the scarped sides of rocky hills, must not be considered as presenting the form, unchanged, which they at first received from the hand of creative Power, but as the result of a series of natural causes, or of laws, originally impressed on inert matter, and acting through duration indefinitely extended; similar in kind, if not in degree, to those causes which are still found to be engaged in modifying the material creation, and in producing further changes.

The examination and comparison of a number of mine-sections, exhibiting the products of a given district, clearly shows that the relative position of the principal beds or *strata* is nearly the same, through a considerable extent; while the general parallelism of their arrangement, and the frequent discovery of the remains of organized bodies, both animal and vegetable, distinctly refer the inquirer to the long-continued action of *water*,

as principally instrumental in the course of mineral deposits which is presented to his view;—and when on further inspection, it is found that these parallel strata are, in certain situations, elevated at various angles, forming abrupt and lofty eminences; that their continuity is occasionally and suddenly interrupted by spaces filled with extraneous and irregularly dispersed matter; and that, at such points of interruption, the entire mass is frequently elevated or depressed, the disrupted faces presenting precisely the same order of formations, but lying, respectively, considerably nearer to or more remote from the surface,—the mind is irresistibly led to the conclusion that at various periods, during the term in which the work of gradual deposition proceeded, powerful moving causes were at work, producing effects similar to what we term earthquakes; and which, reasoning from every analogy, must have been the results of the action of elastic vapour generated by heat.

The observation and elucidation of these causes and these effects, is the department of the science of GEOLOGY;—and full of apparent difficulties as is the study, inadequate as the trifling researches of man into the internal structure and formation of a body so immense as the globe of the earth may appear to be, still, the more sedulously inquiry is pursued,—the more active is science in drawing instances from distant spots on the earth's surface,—the more evident becomes the great canon or principle of Geological Science, that the present aspect and condition of the crust of the earth is the result of the alternate or combined actions of water and fire; arranging, disturbing, distributing, shattering, and

re-composing the various elements of which the matter of the globe consists, under the superintendence of a wise and benevolent Providence:—thus presenting in almost infinite variety, combinations which the ingenuity of man turns to his use, and by which his comfort and happiness is promoted; so placed by the great agents of nature, that in different situations the valuable strata become by turns accessible to his industry.

In the mining districts to which we shall have occasion to refer, the reader must carry his thoughts back to a remote era in the world's history, before the face of the globe presented its present varied aspect of hill and plain, of mountain and valley, of grove and flowery field;—he must imagine the prevalence of an ocean or sea of indefinite extent, peopled with numerous species of marine insects, zoophytes, and shell fish. The original sandy floor or bottom of this ocean, it must be concluded, was by degrees covered to a great thickness, with a deposit of *lime*, with the particles of which the waters were strongly impregnated, and whose gradually increasing and originally soft and yielding body continually received the exuviæ and remains of the living creatures as they perished. The total thickness of this bed of lime, which by time and pressure has become indurated into a very compact rock, is in some parts upwards of sixty yards, every portion of which space abounds in the evidences of its gradual deposition, and of the multitudinous profusion of animal life with which it was charged. Surprising and almost incredible as it may appear that a stratum of such immense thickness should be so formed, it is however perfectly consistent with what is even now

taking place in certain distant countries. In Italy, for instance, many of the streams and rivers issue from their sources so strongly impregnated with calcareous or limy particles, that deposition rapidly takes place, and in the course of a few years strata of several feet in thickness are formed, the material being sufficiently hard and compact to be used for building stone.

The next change of which it is necessary to conceive, is the gradual elevation of the bottom of this ocean, so as to give it, generally, an undulated character; while in some situations, the moving force having been more powerfully exerted, the lime, with a portion of the lower rocks on which it reposed, was raised into upper air, forming mountains and precipitous ridges, which it may be presumed were gradually covered with vegetation, when, by the action of the atmosphere, their surfaces became fitted for the reception of such production, and when these elevated spots were reduced to a condition to support and renew vegetable life.

Thus then, between these various elevations, remained deeply hollowed troughs or *basins*, which in their turn were slowly filled up by the action of water, washing from the higher spots, the various materials of which they were composed, and which, mingling in new proportions, form the strata which now present varied appearances, and have received different names. Among other substances thus deposited, were immense quantities of vegetable matter, carried down by rains and rivers from the spots on which they were produced, and where they must have flourished in a degree of luxuriance of which we can have but an imperfect idea, and of which examples are seen

only in tropical climates. This vegetable matter, mixed with other particles, and like the other deposited strata, submitting to the transforming power of time and pressure, is now known as *coal*, of which the beds are found in many of these valleys or basins, of various thicknesses and at different depths. That such was the origin of coal, is unquestionable from the abundance of vegetable remains and impressions of vegetable forms, which are observable in every coal stratum, numbers of which still preserve with sufficient distinctness their original forms, so as to enable the Geologist and Mineralogist to call in the aid of botanical science in order to determine the species to which they belonged. These researches declare that the principal vegetable components of our coal strata belonged to the tribes of grass, reed, and fern, of which numerous varieties are pointed out;—and those specimens which can be exhibited in any degree of entireness evince a gigantic growth which leaves all that is at present known of these species of plants, far behind.

Thus the various valleys or basins which were once covered with water, were gradually filled up with a succession of different deposits, vegetable and earthy, mixed with metallic ores, and varying in their elements and in their proportions, according to the circumstances which happened to prevail. But during this long process the occasional action of earthquakes produced by subterranean heat continued, making great changes in the position of the stratified mass; in one place elevating large areas into undulated forms; in other situations shattering the entire crust, and raising and sinking alternately the disjoined faces of the fissures; discharging

copious jets of fused and fluid matter, similar to the lava of volcanic regions, which sometimes filled up the fissures or interstices between the opened rents, sometimes insinuated itself between the strata, and sometimes rose above the existing surface, forming as it cooled, hills of the new material. And still the work of change went gradually on; precipitous ridges were rounded, and deep valleys and gorges filled up by the continued action of the air and water; till at length the surface presented a varied country, capable of supporting its intended concomitant productions of animal and vegetable life.

Such is the process which the Geologist, reasoning on the facts which the miner describes, conceives to have taken place:—and the results of such a series of causes, and such variations of material and position, will be observed and pointed out, as we have occasion to allude to the different mine-sections, to which we shall have occasion to refer.

The lowest stratum or bed of deposited matter which the labour of the miner reaches in the coal districts, is, as we have observed, a bed of limestone, differing in quality and in thickness, in different situations; but in all bearing the marks of aqueous deposition, and abounding in the forms of marine animals. In the centre part of the South Staffordshire basin this limestone lies at a depth of nearly 300 yards from the surface, but it is brought up to view at Walsall and at Dudley, which form the east and western boundaries of the uninterrupted coal field. In Shropshire, similar elevations, though not so decided in their character, near Newport, at the Wre-

ken Hill, at Much-Wenlock, and in the neighbourhood of Colebrook Dale, in like manner circumscribe the trough or hollow in which the coal measures in that quarter are found. Similar observations may be made in reference to the coal fields of Warwickshire and other parts. This limestone is of the kind sometimes called *secondary*, as succeeding the *primitive* strata, or those wherein no animal remains are discovered. It is also called *carboniferous* or *coal-bearing*, because the coal, and its accompanying strata, lie upon it. It has likewise been distinguished as *mountain limestone*, from the circumstance of its being found raised to great elevations and forming parts of lofty and precipitous ridges. This circumstance indeed proves the great antiquity of the stratum, because the more recent deposits of the same material are seldom in any great degree found so disturbed. Beneath this *secondary* limestone no coal is found, but there are other beds of more recent date, such as magnesian limestone and lias, which take their place among the *tertiary* strata, or beds of different material deposited by the posterior and continued action of air and water, decomposing and re-forming the earlier elevated masses of matter. These upper beds of lime are usually found in their original horizontal position; they approach the surface, are of various thicknesses, and abound in animal remains,—all marine, but of different character from those which people the older lime strata. Thus, a bed of the magnesian limestone, nearly 60 yards in thickness, is reached within a few yards of the surface in the Durham coal field; below which occurs the coal in numerous thin measures, with its accompanying strata of

taking place in certain distant countries. In Italy, for instance, many of the streams and rivers issue from their sources so strongly impregnated with calcareous or limy particles, that deposition rapidly takes place, and in the course of a few years strata of several feet in thickness are formed, the material being sufficiently hard and compact to be used for building stone.

The next change of which it is necessary to conceive, is the gradual elevation of the bottom of this ocean, so as to give it, generally, an undulated character; while in some situations, the moving force having been more powerfully exerted, the lime, with a portion of the lower rocks on which it reposed, was raised into upper air, forming mountains and precipitous ridges, which it may be presumed were gradually covered with vegetation, when, by the action of the atmosphere, their surfaces became fitted for the reception of such production, and when these elevated spots were reduced to a condition to support and renew vegetable life.

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the ground. It is distinctly divided into columns of considerable length, each column being of one piece, with the peculiarity in their position of lying nearly horizontal.

Comparing all the circumstances attending the position of the lime, the coal measures, and the basalt or rag, the probable conclusion is, that the latter substance was the constant accompaniment of the great moving power, in the districts where it occurs. That existing in a fluid state in the deep recesses of the earth, where various chemical causes would combine to generate intense heat, the elastic vapour which would necessarily be evolved, would at different times acquire sufficient force to heave and bend the limestone and the superincumbent strata, or to break and separate their portions, as circumstances varied, causing those dislocations to which we have alluded, which are every where discernible where the older strata are, from any cause, laid open to inspection, and which are by miners termed *faults* or *dykes*. Thus total or partial fissures would be formed, into which the fluid lava would sometimes be injected, forming the masses of *green rock;* or through which it would, as at Rowley and Pouck Hills, rise, covering the neighbouring earth and forming abrupt protuberances of the newly emerged material.

We have ventured to preface our description of the mines and mining operations of the various coal fields to which we shall have occasion to advert, with the foregoing succinct sketch—not as forming even an *outline* of the vast and deeply-interesting science of Geology, but as elucidatory in some degree of the singularities and

peculiarities in position and stratification, which the examiner will observe, when the interior of the earth is laid open to a considerable depth, and submitted to his observation, as in our accompanying chart.

We now proceed to offer a detailed account of the mineral productions of some of the most remarkable and important districts of this country, referring as we proceed, to the facts exhibited in the "CHART OF MINE SECTIONS," and presenting throughout the whole, such data and calculations as will be found practically useful; —commencing with the COAL-FIELD OF SOUTH STAFFORDSHIRE.

THE MINER'S GUIDE.

THE SOUTH STAFFORDSHIRE MINING DISTRICT.

The South Staffordshire coal and ironstone mines occupy an area, nearly 22 miles in length, from Stourbridge, in Worcestershire, to the neighbourhood of Rugeley; and about 6 miles in its greatest breadth; the total superficial contents being nearly ninety square miles. But this extended space is divisible into two distinct portions, of which the southern is circumscribed by a line drawn from Wolverhampton through Walsall, West-Bromwich, Oldbury, Halesowen, Stourbridge, King-Swinford, and Sedgley, to the point of its commencement at Wolverhampton. Within this latter circuit is confined the great and important stratum, called, from its average thickness, the Ten Yard Coal, which, beyond this boundary, either ceases, or divides itself into beds of inconsiderable thickness, or lies too deep to be reached.

The coal and ironstone procured from the mines of this district are both of the first quality. The metal produced is brought into the market as pig, or bar and rod iron, according to the mode of its treatment; and is applicable to nearly all purposes of arts and manufacture. Much of it is consumed in the various foundries in the

neighbourhood, and in that busy emporium of the mechanical arts, the town of Birmingham. Vast quantities are also sent to London, Liverpool, and other places. The coal is raised in quantities almost inconceivably great, and is used for the supply of the hundred furnaces which are thickly placed in this district;—for the various operations of the forge, the foundry, and the numerous branches of manufacture which are congregated in the neighbourhood;—and for domestic purposes. Much is also sent to a distance; into the farther parts of Warwickshire, into Northamptonshire, and other quarters. For the easy transit of these heavy materials, canals are constructed, which diverge from this focus of operation, and radiate in every direction. The great road from Birmingham to Holyhead, Liverpool and Manchester, also traverses it, and it is crossed by the line of the projected railway, in the same direction.

Throughout the greater portion of this southern half of the coal field, the order of stratification appears to a certain extent similar; but the distance from the surface, at which any given stratum is found, varies greatly in different situations. Thus, towards the centre of the district, the ten yard coal lies at the depth of 140 yards or upwards; but as we proceed northward the depth decreases, and the upper beds in succession are wanting, till, in the neighbourhood of Bilston, the thick coal itself comes to the surface, or *crops out* as it is termed, and is lost. From this point, still ascending northward, coal is found at Bloxwich, through Cannock Chase and Beaudesert Park, but the strata are comparatively thin, and are probably the continuation, in a form more or less

varied, of the lower mines or beds which are found under the thick coal in the southern part of the coal field.*

It appears therefore, through the entire district, that there is a gradual slope or *dip* of the strata from north to south. This great general feature must be borne in mind, and will afford a key to many of the phenomena which the inspection of our chart of sections presents. Presuming, in accordance with the Geological Theory of which we presented a brief outline, that all the strata were successively deposited by aqueous action, and consequently in a position horizontal, or nearly so; the supposition follows that the entire field must have been subjected to the action of immense moving powers, sufficient to elevate the continued face of the stratification in the manner we have described; and that the thick coal and its overlying beds, which are found in regular succession in

* It is not improbable that considerable variation in the quality and texture of mineral strata, is caused by the presence or absence of long-continued *pressure*, and the varying temperature which would be thus occasioned; and that, the upper deposits, being *deficient* in the northern part of the coal field,—and the pressure on the others being consequently diminished, may thus account to a certain extent for the modifications in the quality of the coal. Those who have been long familiar with specimens collected from the hills near Dudley, have observed that for some time after the opening of the lime works, and so long as the *exterior* portion was excavated, the various prevalent animal forms were found in considerable numbers, and in very perfect condition, but as the mining operations penetrated into the interior of the hills, where the consistency was more compact, owing to the increased pressure, fine and entire specimens became more and more scarce, and are now seldom found.

the deeper situations, have been in the course of ages, gradually reduced in the elevated parts, and their components dispersed, causing the various strata, as we see them in the different mines, to rise or *crop out* in succession, and thus forming a comparatively levelled surface.

Such is the position of the coal strata in reference to their situation from north to south; but still greater and more remarkable variations are observable in other directions, where the great substratum of limestone is elevated from the depths at which it was originally formed. The results of these tremendous operations of nature are strikingly exhibited at Dudley, where the limestone forms the principal constituent of considerable eminences; and where it is raised from its original horizontal position, and presents itself at various angles, from 30 to 80 degrees;—and at Walsall, where the slope is more gradual, but where it just emerges above the level surface of the earth. Other similar appearances occur in other parts, and in all cases the overlying strata, as they approach the point of elevation, become thinner, and are rendered indistinct and of little value,—thus indicating the truth of the theory, which presumes that the limestone was *gradually raised* during the period when the depositions were forming; the natural consequence of which would be that the succeeding strata would be less and less perfectly developed, and that the operation of atmospheric phenomena, and the action of water, in the lapse of after-ages, would scatter and disperse the exposed edges of the strata, which were subjected to their influence.

The fact of the existence of this bed of limestone, as

Fig. 1. P. 15.

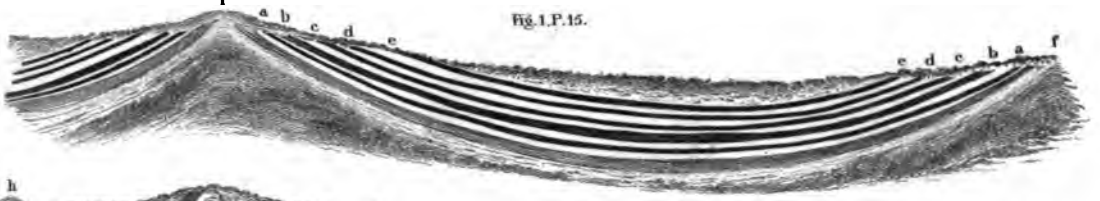


Fig. 2. P. 16.

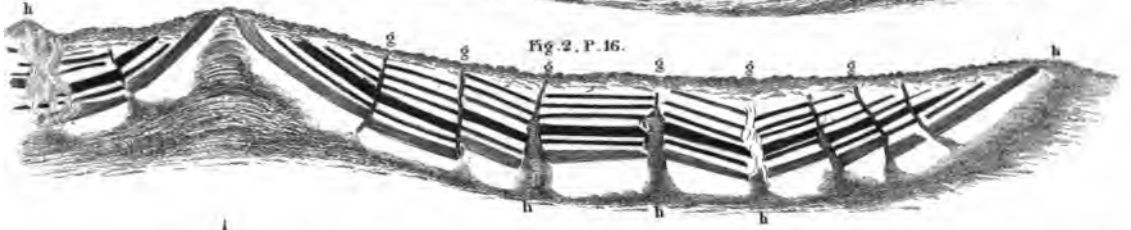
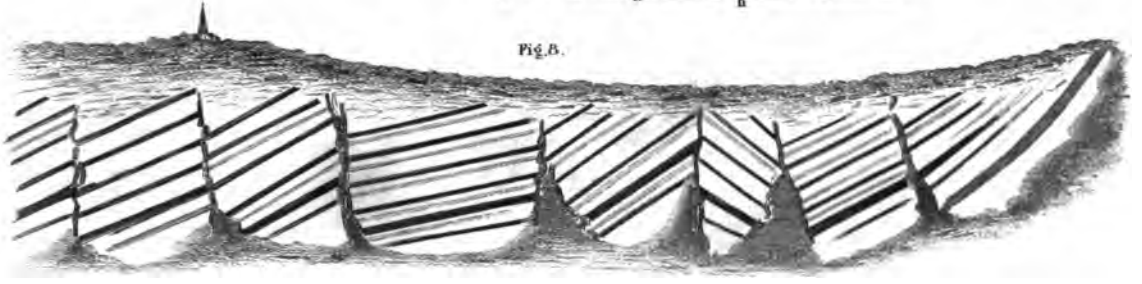


Fig. 3.



a continuous substratum under-lying the coal measures through the *deep* of the coal field, is not entirely left to be conjectured, or to be inferred from analogy, but is found to be fact in various mining works, where, from any cause, the operation has been carried on to a sufficient depth in the order of stratification, below the ten yard or main coal. Such is the case at Hill Top, in the Parish of West Bromwich, and again at Dudley Port, in both which instances the limestone is reached at the depth of about 180 yards from the surface, the shaft, in the latter case, having cut through a *fault*, where the great and abrupt change of level has raised the lime so as to be only a little lower than the ten yard coal, to obtain which the pit had been sunk.

In order more clearly to exhibit the mode in which the various strata are disposed, in the hollow or *basin* which is formed by the rising limestone, we may refer to the accompanying figure,* which must be supposed to represent a section or deep cutting through this basin from south-west to north-east; the elevated extremities giving the position of the limestone at Dudley and at Walsall.

In this figure the course of the lines shows the order in which the various beds of coal, ironstone, and earthy matter prevail through the great basin which they occupy, till we arrive at the limestone, which is the lowest useful stratum penetrated by the industry of man. On this limestone were deposited the various layers of matter,

* Figure 1.

stone hills terminate, commences the range of eminences to which we have adverted, consisting principally of basaltic rock, or rag. These proceed in a south-easterly direction to Rowley Regis. From the direction of the strata at the foot of these hills it seems probable that the coal extends at least to some distance beneath them, as it might be presumed would be the case, if the hills consist, as supposed, of matter ejected in a fluid form from a fissure in the strata, and spreading over the surface.* It has been also remarked, that, as the coal approaches the seat of this volcanic lava, its quality deteriorates, and it is found to approach the character of coke; thus evincing that it had been, at some remote period, subjected to the action of violent heat. The thick coal is however found surrounding these hills, and extending from Oldbury towards Halesowen and Stourbridge, till it is thrown out by the limestone which is seen in considerable elevation in that quarter, and where quarries are now worked. In this portion of the coal field, however, or to the south-west of the great hills of lime and basalt, it is to be observed that the disturbing forces appear to have acted with peculiar violence; faults are more frequent here than elsewhere; the *dip*, or inclination of the strata is, in

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* See the admirably explanatory letter of the late Mr. Keir, appended to "Shaw's History of Staffordshire." Mr. Keir's account is dated 1783; at a period when inquiry was comparatively young, and research imperfect, yet his deductions from observation and analogy were so perfect, as to leave, in respect of the great features of this tract of country, comparatively little to be done by future Geologists.

most parts, very considerable; and in many situations the hard substance called green rock, supposed as we have said to be, in its component parts, identical with the basalt or rag, is found interrupting the progress of the miners, and causing heavy expenses and immense labour before the impediment is removed.

Proceeding in a northerly direction, but still to the west of the basaltic hills, good coal is found through the parish of King-Swinford, the ten yard strata being little changed; but farther on, towards Sedgley, Wombourne, and Penn, the mines diminish in value, while their depth increases, till they are no longer capable of being worked. Several miles to the west, in the county of Salop, coal and ironstone measures are again worked, as we shall hereafter have occasion to note. These strata are found here also to over-lie a deep mass of limestone, which appears above ground beyond the River Severn, and near the town of Much-Wenlock. This limestone, in its general appearance, and in the animal remains in which it abounds, corresponds nearly with that of Sedgley, and it is not improbable that it is in fact part of the same great formation. The arrangement of the coal and other strata, it is true, differs considerably from that of the South Staffordshire basin. Still, when the variations which are observable *within* the circuit of that basin, are considered, such as the separation of the flying reed from the mass of the ten yard coal, to the north;—and the subdivision and diminution of that great stratum to the south and west; it is not improbable that the Shropshire coal field is in fact a further development of the basin, of which the Sedgley mines form the eastern edge; altered

and modified by the circumstances attendant on the gradual deposition of the various strata.

Such a view of the subject would seem to indicate that the limits we have mentioned, as enclosing the richer coal field of South Staffordshire, were originally marked by nature as its boundaries; and that the "ten yard coal," dismembered and lost near Bilston, and divided into several seams towards Stourbridge, will not in any direction be found to extend far beyond its present known limits.

The limestone is of two kinds, called by the miners the *black*, and the *blue* or *white*. They bear decided marks of difference both in colour and quality, if specimens from different situations be compared, but it is not easy to point out the spot where the change takes place. The *blue limestone* is seen at Dudley Castle, the Wren's-nest Hills, and at Walsall; and it prevails generally, when worked in the *deep* mines. It is extremely hard, and the entire worked stratum is nearly homogeneous. The *black* limestone is exhibited at Sedgley, and at the Hayes, near Stourbridge. Its colour is darker, and it is found in balls or nodules rounded as by attrition, and embedded in a stratified mass of inferior quality, being deteriorated by an admixture of clay. It is imagined by some that the *black* lime, in the order of stratification, lies below the *blue*. This however can scarcely be the case, from the circumstance of its being a species of *conglomerate;* (to use a geological term;) that is, composed of *rolled fragments*, obviously from *an older* formation, dispersed through an indurated mass of different quality, the combination taking place when the latter was in a

soft state. The observation of the miners, generally is, that the best mines both of coal and ironstone, are those which lie upon the *blue* limestone.

In those parts of the district where the stratification is most regular and entire, many beds both of coal and ironstone are worked. These are all known by different names, some of them of old standing, very quaint and uncouth, partly descriptive, and partly apparently arbitrary, but all, probably, originally intelligible, arising out of some long-forgotten circumstance attendant on their finding or working.

The first coal beneath the surface is called *brooch* coal; this is followed by the *thick coal*, of which, as we have noticed, the upper measures, when detached, are known as *flying reed*. Then the *heathen* coal, the *rubble* coal, the *stinking* or sulphur coal, the *new-mine top and fire-clay* coal, and the *new-mine bottom coal*. Of these strata it is generally found that the brooch and the thick coal, both for domestic purposes and for the supply of the furnace and the forge, are preferred to the lower beds, owing to the larger proportion of *sulphur* which is combined in the lower coals.

The beds of ironstone lie in the following order. Within a short distance below the main coal is found the *black*, or *top-gubbin* ironstone, which is the first stratum that is generally worked. Under this, at different levels, within a total depth of about 100 yards below the thick coal, lie the strata vernacularly known as *poor robin*, *white ironstone*, *balls*, *bottom-gubbin*, and *blue flats*; below which no valuable minerals are usually found till

the lime is reached at an additional depth of about 80 to 100 yards below the last bed of ironstone.

Of the relative position of the strata, some idea may be formed from the following data, as to the distance or depth from the surface to the thick coal, and other beds, in various situations.

In the mines of W. Sparrow, Esq. near Wolverhampton, the thick coal and the other upper strata are wanting, having cropped out and dispersed. The *rubble coal*, which lies, in the order of stratification, about 16 yards below the thick coal, is here found at only 10 yards from the surface.

At Friezland, near Wolverhampton, given in the chart of sections as the mines of Messrs. Williams, the distance from the surface *through* the thick coal, is 30 yards 2 feet.

In the mines of W. S. Bickley, Esq. near Bilston, the distance is 29 yards; at other mines, half a mile from Bilston on the road to Wolverhampton, 16 yards.

In the Caponfield iron works, also near Bilston, the depth is about the same; but the space of 30 or 40 yards carries us across a great fault which occurs there, and the thick coal at once drops to the depth of 140 yards.

In the mines of Messrs. Lloyd and Foster, near Wednesbury, the first coal found is the *new-mine*, at the depth of only 28 yards, its place in the course of the strata being nearly 40 yards below the thick coal.

In other mines near the last, thick coal is found at a very few yards from the surface.

In several situations at West-Bromwich and Oldbury, the thick coal is found at the depth of 100 yards.

At Dudley Port, on the eastern side of a great fault, 180 yards.

Near the same spot, on the western side, 80 yards.*

At the Moat Colliery, Tipton, 140 yards.

At Sodom, near Sedgley, approaching the limestone hills, 5 yards.

The above situations all lie to the north-east of the limestone and basaltic hills. Rounding to the south-west of these elevations :—

At Halesowen the thick coal is reached at various depths, from 150 to 250 yards.

At the Dingle, near the Hayes-quarries of black limestone, after rising at the rate of 18 to 24 inches to the yard, the thick coal and the lower beds are seen to crop out in rapid succession at the back of the lime.

At King-Swinford the same coal is found at 110 to 140 yards from the surface; the depth constantly varying.

In order to obtain some definite knowledge of the strata which prevail at a given spot, not yet proved by mining, recourse is frequently had to the operation of *boring* deep into the earth by means of iron rods, jointed one to the other to any required length, and driven forcibly into the earth. The information thus obtained does not amount to certainty, because the tool may happen to cut through a casual ball of ironstone or other mineral, lying detached from any regular stratum, and

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* In this instance the movement of the fractured sides of the strata appears to have taken place without injury to the faces, there being almost literally no space between the two sides.

thus an erroneous conclusion be drawn. Still the practice may, in certain cases, be beneficially adopted;—perhaps most of all when the boring is commenced from the bottom of a mine, where the quantity of water is so great as to increase considerably the difficulty and consequent expense of sinking the shaft, in expectation of reaching the lower mines.

The boring rods are one inch in diameter, and are driven into the ground by any conveniently-used descending force, screwing on additional lengths as fast as those already applied sink to the level of the earth. The lowest rod is flattened at the end in the form of *a chisel*, the more easily to penetrate hard and rocky strata. The whole are occasionally withdrawn, and a *hollow rod* used at the lowest length, which being driven down, brings up some particles or fragments of the stratum last reached. Ground has been thus tried by boring, to the depth of 150 to 200 yards. In the chart will be observed the specification of "strata BORED at Smethwick, in land, the property of Mr. Horton." Here, the tool has descended 187 yards;—and the result tends to confirm our position as to the extent or accessibility of the coal deposits.* Throughout this considerable depth, the entire strata penetrated, are *rock*, *marl*, and *sand*, in various thicknesses and of different degrees of hardness, but presenting no indication of an approach to coal or ironstone.

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* See Page 20.

MINING OPERATIONS.

LONG WORK.—BROOCH COAL.

THE valuable strata which form the wealth of a mining country, generally lying far below the surface of the earth, are attained, by sinking circular openings like wells, called *pits* or *shafts*, from which, passages or roads are excavated, at different depths, for the getting out of the various strata in succession.

At every considerable colliery two pits are sunk, at the distance of six or seven yards, the one from the other. At the head of each pit is erected a wooden frame, from which is suspended a wheel or pulley; over this pulley passes a rope attached to the drum or barrel-wheel of the *whimsey* or *gin*, and of length sufficient to reach the bottom of the shaft. By means of these ropes the carriages bearing the coal, and called *skips*, are raised or lowered; one being always in the act of ascending while the other is descending.

The moving power is usually that of *steam*, and the drawing-engine has received from the workmen the trivial name of the *whimsey*,—probably given by the unwilling deserters of antiquity, as a contemptuous allusion to the needless folly of the fantastic novelty. The older and simpler contrivance is the *gin*. It consists of a drum-wheel which carries the rope. This is supported

by a vertical axis, and caused to revolve by the circular movement of a horse, harnessed to a projecting bar of wood; thus raising or lowering the rope with its burdens. The *gin* is still occasionally used in collieries and other works, of minor extent.

As a greater or less quantity of water is almost always found in coal mines, the means of getting rid of this annoyance, are a source of anxious attention. The springs which are found in the course of the shaft itself, are carefully stopped by means of the brick-work or other material with which they are lined. The water which issues from the working strata is pumped up by a proper application of a portion of power from the whimsey or working engine; but if the quantity be very great it is necessary to have an additional engine, termed the *mine* or *water engine*, to clear the pit. This is sometimes required of great power, and a third shaft is sunk for the reception of the pumps which it works.

In certain situations one powerful water engine is made to drain several collieries. In this case a narrow passage or channel, called the *main level*, is driven or excavated, so as to command a fall from the different works,—from each of which descends a HEAD or *level*, in order to convey the water to the main level, from which it is drawn by the water engine placed at the lowest point. See figure 4, in which Q, R, is the main level, drawing off the water from the colliery immediately adjoining, and extending itself indefinitely in the direction of Q, in order to drain other distant works;—the engine pit, R, being placed at the lowest point, so as to secure a gradual descent.

The shafts are usually from six to seven feet in diameter;—the latter dimension is preferable, as giving freer passage to the skips which come up loaded with 15 or 20cwt. of coal. The skips themselves are three feet six inches to three feet nine inches square, and the coal piled on them, is kept from scattering, by means of loose hoops of sheet iron, which are laid round it while being placed upon the skip;—and is farther secured by chains which pass over the whole. For the service of two pits of moderate depth, an engine of twenty-horse power is required, of which the cost is from £400 to £500. The *stroke* or descent of the piston should be five feet.

The pit is generally lined with good brick-work, except in certain parts where it passes through rock of hardness sufficient to render the lining unnecessary. It sometimes happens however that the shaft has to be cut through a bed of sand, so loose, or so full of water, that the sides cannot be supported while the bricking is executed.* In this case the ingenuity of the manager of the work is exercised to discover the means of overcoming the difficulty. This is frequently done by means of open

* It is the observation of the practical miners that a deep bed of sand, which is of moderate breadth, but which extends from the neighbourhood of Great-Bridge, through part of the parish of West-Bromwich, and which is found at about 35 to 40 yards below the surface, bears every mark of having been at some period the bed of a river or torrent; and in digging through it, masses of extraneous matter, as detached lumps of coal, ironstone, lime, &c. are occasionally found, rounded by rolling, and evidently washed in by the action of rapidly flowing water.

cylinders of cast-iron, of the proper diameter, of which, one being let down to the quicksand, the digging proceeds with all possible speed, extending under the circumference of the cylinder till it sinks to a given depth. Another cylinder of the same diameter is then lowered, and placed accurately on the first, and the work proceeds; the two cylinders sinking together, and a third, a fourth, or a larger number if required, being placed in succession one upon the other, the whole range still gravitates downwards, till the loose and watery sand be passed.

The shafts are usually sunk till the most valuable measures be reached; as the getting of this naturally produces the quickest return. The stratum first worked in South Staffordshire, is therefore the TEN YARD COAL, as being vastly more productive than any other. But, as in the course of our details, it seems advisable to proceed in our account of the produce and expense of working the various beds, in the order in which they occur, we commence with the BROOCH COAL, which is technically, the first *getable* stratum;—that is, the first which is of sufficient thickness to yield a profit to the miner; and which is found at a considerable distance above the thick or ten yard coal.

In order to get out a seam thus situated,—the pit being already sunk for other purposes, to a lower depth, the face of the shaft, at the proper spot, is covered with a floor, or scaffolding of planks, and the excavation on the desired level then commences.

The thinner measures of this district are cleared on the system called "*long-work;*" that is—in successive narrow sections of considerable length, the roof being upheld

Fig. 3

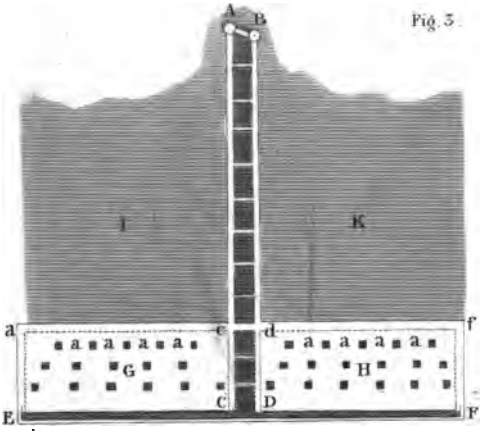
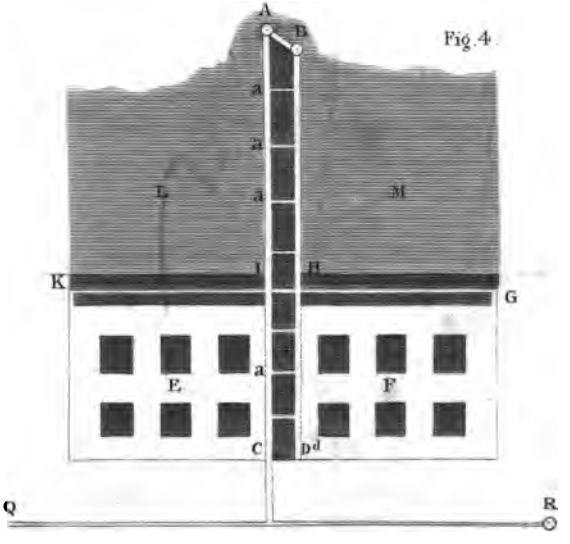


Fig. 4



by artificial means as the work proceeds. This is opposed to the working *by the square*, which term is applied to the getting of the thick coal, in which the material is only partially cleared,—large pillars and ribs being left in the mine, untouched, for support.

The following is a description of the mode of getting coal by *long-work*; the reader being referred for elucidation, to figure 3.

The two pits or shafts, A and B, are sunk at a distance of six or seven yards, the one from the other, the diameter of each pit being, from six feet six inches, to seven feet; and a steam engine is erected of power sufficient to draw out the full quantity of produce expected to be raised daily from the mine. Two passages, termed *gate roads*, A, C, and B, D, are then formed, or *driven out*, extending in a parallel direction from the pits to the extremity of the intended working, and tending towards "*the deep*" of the mine. These gate roads are from 4 to 5 feet wide, and divide the intended area into two equal parts, called "sides of work." The mining then commences at the farthest point, and is continued *homewards*, or towards the shafts. The solid wall of mineral presented to the workmen as they proceed, is called "a face of work," as a, c, and d, f, and the part not penetrated is termed "ungot coal."

At the distance of three or four yards beyond the termination of the gate roads, is driven a narrow passage, not more than three feet square, extending each way at right angles with the roads, as E, F. This passage is called an AIR HEAD, and is opened for the purpose of producing a current of air through the caverns of the mine, which

is absolutely necessary for the safety and health of the miners, both as driving off the deleterious damps or gases which are so dangerous; and as dissipating and carrying away the impurities which are generated in the close chambers of the mine. These heads communicate in different ways with the opened workings. We shall have frequent occasion, as we proceed, fully to describe the construction and position of these useful and necessary passages, which may be termed "the lungs of the mine." In the figure now under description, the life-giving stream descends by one of the shafts, as B; proceeds along its gate road, B, D; spreads itself over the working on that side, then passes through the air head, F, E; extends itself over the other *side of work*, G, and finds its way along the gate road, to the shaft, A, by which it reascends.

The mineral, whether coal or ironstone, is got out as we have said, in convenient sections, each of such extent as to be cleared in *one day*, by the workmen employed. We may take an extent of 30 yards in length and one yard wide, as the average size of these sections. The work commences on the faces on either side a, c, and d, f, the roof of rock being supported as the clearing proceeds, by the pillars or cogs a, a, a, constructed of stones, earth, slack, or any other refuse material which the measures, respectively, supply, assisted generally by strong perpendicular pieces of timber, carrying transverse planks, on which the roof, if disposed to sink, reclines with less hazard to the miner. These timbers are withdrawn when the part where they have been used, is cleared,—to be used again in the recent working. The excavation is con-

tinued till the whole of the coal or ironstone is got, leaving only a sufficient quantity round the shafts in order to give them support, and to preserve them from sinking. It is the practice of some persons to carry away the minerals quite up to the shafts, constructing buildings to support them, under the idea that the *settling* and shrinking of the building will be uniform and simultaneous with that of the hollowed earth, and will proceed without much hazard or injury. It seems, however, far better to leave the requisite quantity of natural support to those important parts of the work; for if the stability of the basis be infringed on, the bricked sides of the shafts will crack in various places, and the strata which surround them, being disunited by the intermediate clearings, frequent and considerable disruptions are to be apprehended, to the imminent hazard of the lives of those who may be ascending or descending, besides the constantly required expense of repairs, which will defy all calculation. Economy therefore, as well as humanity, dictates the sacrifice of a competent portion of each valuable strata, as support to the avenues by which they are all attainable. Besides, if once well secured and strongly defended, the pits are available for any length of time, and for any additional sinking, should mines below the usual sinking be eventually formed. The dimensions of the gate roads must be sufficient to admit of the free transit of the waggons or skips used to carry away the coal, the produce of the working. The quantities thus carried at each time, being regulated by the intention of the mine proprietor as to the total to be got *per day*;—larger carriages and heavier loads being

adopted in extensive works, in order to lessen the number of daily transits.

We proceed to apply this general description to the measure under consideration, namely the *brooch coal*, which is usually one yard and nine inches in thickness. When the proper gate roads are headed out, it is *holed under* along the faces, a, c,—d, f; that is, its lower portion is hollowed away in an horizontal direction with as little waste as possible, penetrating in a wedge-like form, to the width of *one yard*, the tool used being called a *pike*, resembling that which is commonly known as a pick-axe.

The length of 30 yards is holed in one day by a competent number of workmen, and is divided into four sections of about seven yards each. At the end of each of these sections or *holeings*, a perpendicular crevice is made, also as narrow as possible, but extending into the body of the coal, as far as the horizontal excavation. This crevice or fissure is called the *cutting*. At the end of each section, therefore, a mass of coal of about seven yards long, one yard wide, and of the thickness of the stratum, hangs, supported only at the back. The holers have now done their work, and proceed to another section; the coal is *brought down* and cleared away by the labour of others, whose work is termed *brushing*, and who likewise execute the task of *cogging*, that is, supporting the superincumbent roof by raising up heaps or *cogs* of the refuse coal, small slack, and earth; and fixing the temporary timber supports when required. This course of operation is repeated until the area be cleared.

One man will generally hole under five yards per day, executing also the requisite *cuttings*, for which an extra

charge is made; and three men will brush and cog the whole 30 yards in one day.

The mode of bringing down the coal, differs according to the quality of the stratum. If the coal be soft and disposed to laminate, it falls, with the assistance of moderate leverage, after the holeing and cutting are completed. If very hard and compact, additional force is required, and the assistance of the gunpowder blast is sometimes necessary.

As the brushing and cogging proceed, the coal is placed on the carriages or *skips*, to be drawn away. The skips run on railways which extend the whole length of the gate roads, with temporary bends and turns to reach the spot, where the work is going on. The *loading and drawing* is an important item in the cost of mining. It includes the charge of horses, of timber, and of the temporary railways, as well as the wages of the men and boys employed in this part of the work. The business of the drawers-out does not cease till the coal be conveyed to the bank or other spot on the surface, where it waits to be loaded into waggons or boats. If the produce of the mine be drawn to a greater distance than 100 yards from the pit's mouth, an extra charge is incurred of one penny per ton, for every hundred yards of additional distance.

Thus then, to hole, brush, cog, and draw out 30 yards long and one yard wide, of the brooch coal, per day, the cost and labour will be as follows:—

Six holers, at 3s. 6d. per day.....	£1	1	0
These also charge for cutting.....	0	2	4
Three brushers and coggers, at 4s.	0	12	0
Loading and drawing out	1	2	6
Total...	£2	17	10

The coal produced is separated into three qualities or denominations, differing in the magnitude of the masses in which it is raised;—namely, the LARGE COAL, which is called, per eminence, COALS;—the LUMPS, or that portion which is broken into pieces of diminutive size;—and the SLACK, or that which is still more minutely shattered, but which is, yet, to a certain extent, valuable.

In dividing the sum thus expended, so as to take it as the cost price of the several qualities raised, it is customary to lay the wages of holeing and cutting entirely on the *coals*, and to consider the lumps and slack, in slightly varying proportions, as got at the charge of loading and drawing only, which is usually presumed to cost from 1s. to 1s. 2d. per ton;—and the cost prices of the whole are usually taken at a rate of which the total shall, a little, exceed the actual sum paid for labour: thus—

Thirty yards of brooch coal, holed one yard under, produces—

Coals,...	11 ton 5 cwt.	at 4s. 3d.	...£2	7	10
Lumps,	2 — 10	1s. 2d.	... 0	2	11
Slack,...	9 — 0	1s. 0d.	... 0	9	0
		Total...	£2	19	9

The other elements of the cost of mining produce, are *dead work*, or the estimated share per ton, of the constantly incurred expense of machinery, wages of clerks, interest of capital, &c.—and *royalty*, or acknowledgment, at a given rate per ton, paid by the mining speculator to the proprietor of the soil. These will be noticed in their proper place;—at present it is sufficient to state the first, or *labour cost* of the minerals.

THE TEN YARD COAL.

WE next arrive at the *ten yard coal*, which, as has been observed, is in some parts found entire, or divided only by thin *partings* of various earths;—but in other situations, towards the northern boundary of the coal basin, the upper measure is separated to a considerable distance, and takes the name of FLYING REED. Where this is the case, this upper measure is extracted in a manner similar to the brooch coal.

The flying reed is one yard one foot in thickness, and like the brooch is *holed* one yard under, the length of 30 yards being brought down in four cuttings.

One man will *hole* 7½ yards per day, and it will require one man half a day to execute the perpendicular *cuttings*; 3½ men will brush and cog 30 yards per day.

The cost of labour to get and draw daily the produce of 30 yards will be—

Four holers, at 3s. 6d. per day,.....	£0	14	0
One man, half-a-day's work at cutting,	0	1	9
3½ men to brush and cog, 4s. 6d. ...	0	15	9
Loading and drawing out,.....	1	10	0
Total...	£3	1	6

The following therefore may be considered as the cost price of the produce of the 30 yards, taking the lumps

and slack as before, at the cost of loading and drawing only:—

Coals,...20 ton, at 2s. 6½d.	.....	£2	10	10
Lumps, 4 ——— 1s. 2d.	.....	0	4	8
Slack, ...6 ——— 1s. 0d.	.....	0	6	0
	Total...	£3	1	6

The ten yard coal receives its name from the total thickness to which this extraordinary mass approaches when its measures are entire; but the height of the deposit is generally something between nine yards and a half and ten yards, and the actual thickness of the coal, deducting the *partings*, is about eight yards, two feet, three inches. Its various seams are distinguished by different names, apparently capricious and fanciful, as will be observed by reference to the sections. Of these seams, some are placed with the upper resting immediately on the under; others are divided by layers or partings of earth and sand, from six inches thick to a mere line.

The coal is got out in openings or spaces, called *stalls*, beginning with the lowest coal, and working upwards. These openings may be conceived of as halls or passages of eight to ten yards wide, with spaces of ungot coal between them of the same width, and intersecting each other at right angles; so that the ichnography of a coal mine considered as exhausted, presents an area chequered at regular distances by primitive masses remaining untouched, of eight or ten yards square, as in figure 4. These remaining squares, in fact, form strong pillars to support the rocky roof of the mine.

But besides these "eternal pillars," other masses of smaller size are occasionally left to support the roof of the stalls, during the progress of the work; these are called *man-of-war pillars;* they are 3 or 4 yards square, and diminish in a conical form to the apex. When the rest of the stall is cleared, the workmen with long iron pointed prongs or *prickers,* detach the top of the column from the roof, and the whole is then easily thrown down and speedily carried away. The area to be cleared is laid down by the mine bailiff in portions or "sides of work," of convenient size; one of these sides of work may be 70 to 100 yards long and 50 yards wide, more or less, and is separated from the next side by a thick rib of coal, nearly 10 yards in width, extending the whole length. These ribs are left for the purpose of checking the action of *fire damp,* which is an explosive aëriform fluid, composed of the atmospheric air in the mine, charged with a large portion of inflammable air or hydrogen gas, which is frequently emitted in copious streams from the coal strata. The accidents arising from this active mixture are of the most fearfully tremendous description, as the annals of mining but too well attest. It is capable, to a considerable extent, of supporting respiration, so that the workmen are often not aware of its presence; but a lighted candle is sufficient to ignite and cause the sudden explosion of the entire body which fills the mine, scattering every thing moveable with resistless force, and driving men, horses, and machinery before it, even to the mouth of the pit. We shall have frequently to speak of the various modes of ventilation by which it is endeavoured to dislodge this pernicious guest, through which many valu-

able and useful lives have been at different times sacrificed; its action is also effectually prevented by the use of Davy's Safety Lamps, which are adopted where necessity exists for them; but a skilful adaptation of other means, by which a current of purer air is made to circulate through the windings of the mine, is preferred.

As verbal descriptions are greatly assisted by diagrams addressed to the eye, we here refer the reader to an explanatory figure which may be received as sufficiently accurate for the present purpose, though the precise arrangements vary in different instances, according to the circumstances of the case, and to the judgment and experience of the manager or bailiff.

The pits, A and B, figure 4, being sunk, as already described, to the bottom of the thick coal, passages or *gate roads*, as A C, and B D, are opened from each shaft. These passages run parallel to each other to the extremity of the intended working, and in the direction of the *dip of the coal*. Their length may be 100 or 200 yards, according to the size of the space to be cleared, and they are from two to three yards wide, and from six to seven feet high, each gate road communicating with its separate side of work, as E and F. Along these roads the loaded skips travel to the shafts by which they ascend.

In the direction of and parallel to these gate roads, if necessary, is cut a channel or passage into what is called the *main level*, Q R, which is three feet square, and which receives the water of the mine, conducting it to the lowest part of the work, whence it is drawn up by the *mine* or *water engine* at R.

In some situations, however, the absence of water ren-

Fig. 5

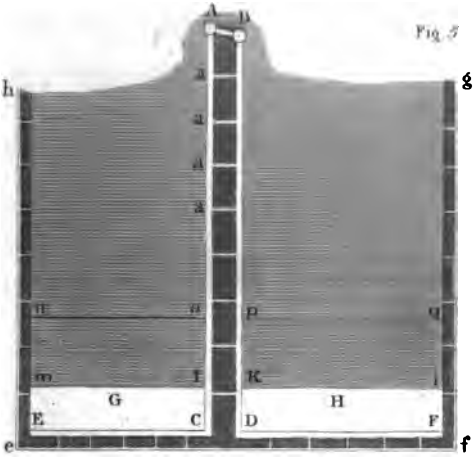


Fig. 6.

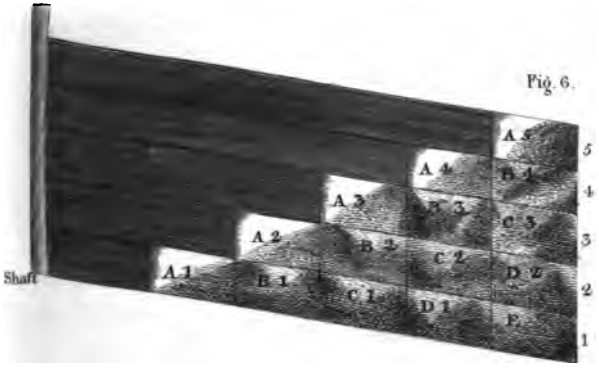
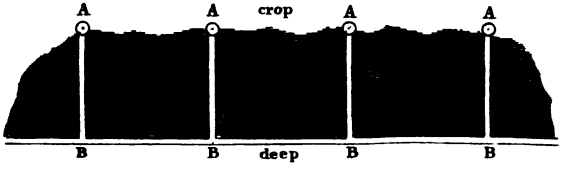


Fig. 7.



ders the mine engine unnecessary, in which case, the *level*, as such, is not opened, but *air heads* are conducted in such directions as experience dictates, in order to effect the important purpose of ventilation; being generally driven through the whole length of the ribs, G H,—I K, and likewise from H to I, across the space between the two gate roads. By this means a current of air is excited, which descends down one of the pits, as B; proceeds along the gate road; extends and spreads itself through the side of work, F, to which it leads; returns along the air head of the rib, G H, on that side; then crosses H I, to the air head I K, in the other rib; flows through the opposite side of the work, E; along the gate road to A; where it ascends through the other pit, carrying with it any deleterious particles evolved from the strata, as well as the impurities arising from the breaths of the men and horses employed, and from other sources. For the proper ventilation of the mine at the commencement of the work, short heads, a, a, a, are cut or *thirled* at intervals of a few yards distance, through the rib which divides the gate roads. These *thirls* supply the work in progress, with pure air, and are closed in succession as the excavation proceeds, being no longer required. If the openings and workings of a mine are well arranged, a regular current constantly circulates through the entire extent, sufficient to ensure the safety and health of the men employed in the pits, who will also work with much more satisfaction when they feel assured that every possible care is taken to prevent accident and danger. In order more effectually to carry off the inflammable air or hydrogen gas—the "*sulphur*," as it is vernacularly

termed by the miners, the air heads should be always driven at the *top* of the coal, or through its highest measures; so that whatever portion of the coal is being worked, the current of pure air may enter the stalls from *above*, otherwise the inflammable gas, being lighter than atmospheric air, might accumulate in the upper hollows of the working, and not be dislodged by the current. For further security, a short road, A B, is cut from pit to pit, which is generally closed by a stout and well-fitting door, calculated to afford a short and accessible way for escape, in case of accident. This road is also occasionally useful as the work proceeds, as a passage for the skips from shaft to shaft, should more coal, from any cause, be cleared from one side, than can be drawn up by the proper pit.

The cost of driving a gate road of average dimensions, is 7s. to 8s. per yard, according to circumstances;—men's wages being reckoned at 4s. 6d. per day, drink and candles included.

An air head will cost from 3s. to 4s. per yard, at the same rate of wages.

When the two first *sides of work*, E and F, are nearly cleared, two others are opened, as in the spaces L and M, on the other side of the ribs, G H—I K; still working out the coal according to the same plan. When the coal is cleared nearly up to the shafts, new gate roads must be driven out in an opposite direction, and similar sides of work opened, with their ribs, air heads, and pillars; being always cautious to leave untouched, a mass of coal from 12 to 20 yards in diameter, round the shafts, to support them and keep them firm during all future workings.

In all cases of coal left in the mines, either as pillars, ribs, or supporting bases to the shafts, regard must be had to the prevalent circumstances of the strata. In some situations, very little water is transmitted through the coal measures; and in such cases, the decay being trifling, the rib or basement may be left of the smallest dimension described; but if the *partings* of earth and clay be thicker than usual, or of a porous quality, giving passage to a considerable quantity of water, constantly oozing from them, carrying with it earthy particles, and thus rendering the support less firm and solid; it is necessary to leave the pillars and other supports of a larger size, so as to suffer greater decay and decrease, without the hazard of breaking down; which, when it occurs, causes great trouble and expense, besides considerable hazard to the men employed in the mines.

By this mode of proceeding;—driving out the *gate roads* at once to the boundary of the intended area of work; getting out the coal from the farthest part first, and the remainder in succession, all that is usually drawn out, is attained in the safest and most effectual manner.

The getting of the thick coal, however, is an operation which, as it requires much skill and management on the part of the miner, claims a more detailed account than the one we have given. We shall therefore endeavour, by a figure, to render intelligible the entire course of the operation.

It will be recollected that the thick coal is got in *stalls* or openings of about eight yards wide; the entire height of the face of work being about 9¼ yards. Commencing from the extremity of the gate roads as at C and D, figure 4,

the first work to be effected is to *hole under* the opening of eight yards, to a width of about two yards or more. In order to effect this, a small passage *or head* is driven, adjoining the rib or pillar, as from D to d, or to the extremity of the first intended *holeing*, in order to facilitate the work; or as it is well expressed, "to *lead* the holers."

The next operation is to make perpendicular *cuttings*, as the boundaries of the proposed stall, and of a convenient height; leaving for safety, while the work proceeds, narrow attached portions of coal, called *sperns*, which prevent the too sudden fall of the coals. The holeing and cutting being completed, the sperns are removed by means of a *pricker* or long staff pointed with iron, when the mass of coal generally falls by its own gravitating force; but should it be without partings, or its cohesion from any circumstance peculiarly strong, the assistance of gunpowder is adopted, to rend the mass by blasting. From 40 to 80 tons, according to the width of the holeing and the height of the cuttings, come down at once.

The work of the *turners-out* now commences, whose office it is to break the large masses into pieces of proper size for placing on the skips. These carriages, when loaded, are drawn by horses to the foot of the shafts, from whence they are raised by the whimsey engine.

The lower measures being removed, no further holeing for the first face is necessary;—the upper strata in succession being easily brought down by cuttings; the men mounting first on the heaps of slack, and afterwards on temporary wooden scaffoldings, to reach the ascending stages.

The entire mass, overhanging the first holeing, to the

top of the thick coal, being brought down in four or five successive stages, the *leader* proceeds to extend the *heading;* and a second holeing is carried under the newly exposed face, which is in its turn cut away from the sides, and brought down in sections as before; and so on till the extremity of the work is reached.

In holeing and cutting to a width of two yards or upwards, it is obvious that the workmen must introduce their entire persons into the excavations, which are therefore, in front, necessarily full two feet six inches wide, —decreasing towards the farther edge of the fissures. The material cut out from the holeings and cuttings, as well as from the *leading-heads*, is entirely waste or small slack, so that the loss in every stage of the work is considerable. Besides which, it will be obvious, on inspection of the figure, and calculating the contents of the ribs and pillars, that upwards of *one-third* of the ten yard coal is permanently left, untouched, in the mine. This is an enormous proportion to sacrifice, out of the valuable boon presented by the hand of the bounteous Creator; and it seems a duty incumbent on man, not to suffer such waste, if by any means it can be prevented.

It is true, the mode of working above described, or "by the square," has received the sanction of ages, but the importance of the object is such as to justify the abandonment of precedent, and the adoption of any reasonable and feasible mode of improving the operation of clearing the thick strata, so as to prevent needless waste, and bring into use the whole, or nearly the whole of these rich treasures.

Impressed by these considerations, the following sug-

gestions are offered,—the result of long and deep reflection, and considerable experience,—as details of a mode of work, which—it is confidently asserted, is safe and practicable, and which, if adopted, will to a great extent secure the economical end proposed.

Having this task before us, we shall defer the calculations of the cost of getting the thick coal, till we can place the results of the two modes of work before the reader, and present a comparative view of their respective produce, and cost in labour.

The getting of the ten yard coal in stalls is denominated, as we have stated, "square work;" we shall therefore adopt for our suggested mode of action, the term "long work," which is already familiarly used in reference to the clearing of the thinner measures, and which distinctly defines the main difference between the two plans.

For getting out the ten yard coal by *long work*, the pits, A and B, figure 5, are sunk, as in the other case, at a distance of six or seven yards from each other; and the main gate roads driven to the boundary of the work at C and D, properly thirled with the openings, a, a, for temporary use, as described in figure 4. From the ends of the main gate roads branches are cut, at right angles, to E and F, along the boundary line of the proposed area to be cleared, so that the mine may be said to be headed in the form of a Roman T, the roads E C, and D F, presenting *the faces of coal*, which are to be worked *homewards*, or towards the pits. Simultaneously with the transverse gate roads, an air head, e f, is driven, at a distance of three or four yards, with its thirls, which

are closed in succession, as the work proceeds. The air heads are continued as the coal is cleared, towards g and h,—the *farthest thirl* only, in all cases, being left open; so that the air, descending down one pit, as B, is forced, for want of other vent, to spread itself over the opened part of the side H; through the farthest, or open thirl, into the head, h f; along the head, f e; round towards g; and back to the pit, A, through the opened part of the side, G.

The necessary roads and heads being completed, the work of *getting* commences; in order to which, the miners hole *one yard under* along the entire faces of work, E C, and D F, which may be each from 50 to 100 yards in length, according to the extent of the area to be cleared. Cuttings are then made at proper distances, to the height of five or six feet, or to a convenient parting, and the coals are brought down, turned out, and drawn away along the gate roads. Cogs or pillars are then constructed, of the waste and slack, to support the upper measures. The holeing and cutting then proceed another yard in width, and another;—still clearing away the coal and supporting the roof with cogs, till the lower measures are drawn out, to the width, along the under face of 8 or 10 yards, to i k,—l m. By this time, the over-hanging measures have, by their gravitating force, sunk, and bedded themselves on the cogs, pressing them down to a sort of continuous floor of what is called *gob*, or compressed and compacted slack. This is assisted by the use, as experience may dictate, of timber, which is taken away when the working of the stage above commences.

The bringing down of a second range, or a portion of the superior measures, now commences, and is carried on in precisely the same manner, in a line the whole length of the face of work, except that the holeing is now made not in the *solid coal*, but in the *gob* on which it rests. This is both easier to the miner, and prevents the great waste of coal attendant on each holeing, in the *fast coal*, or "strait holeing" as it is termed. The coal of this second stage is thus got down to a width of 8 or 10 yards, the roof, as before, being supported by cogs built on the floor of the previous *gob*, assisted by timbers where necessary, and this roof gradually bedding itself on the flattened pillars; while in the meantime the working of the lower measures has still proceeded in advance of the second range. A third stage is now commenced, still higher in the course of stratification, holeing one yard under, "in the gob;"—this is succeeded by a fourth, and a fifth if necessary, till the highest measure is brought down and drawn out, the working of each inferior stage being carried on to the width of 8 or 10 yards in advance of the one next above it.

We shall endeavour further to elucidate the operation by another diagram, figure 6, in which A, B, C, D, presents the *section* of a *side* of *work* in the thick coal; the figures 1, 2, 3, 4, 5, indicating the successive stages in which it is brought down by the long work; the spaces a, b, c, d, e, are supposed to be each 8 or 10 yards in width. Thus, according to the previous description, e, is first cleared, by a series of *holeings* of one yard wide each, the roof being supported by cogs or piles of waste, assisted by timber if required. This done, space d 1, is

holed out, and at the same time d 2 is commenced, in each case supporting the pendent roof with timber, and pillars of slack. In a similar manner c 1, c 2, and c 3, are simultaneously cleared; then the four spaces marked b; afterwards those distinguished as a 1, a 2, &c.—and so on, each *upper* stage being "holed in the gob," or compacted mass of slack, on which the mass has been supported. And thus the work proceeds, each *lower* section being as already described, its length of 8 or 10 yards *a-head* of the one above it; the successive upper measures, being so far loosened by their gradual sinking down on the cogs, that they will generally fall without the necessity of cuttings or blasting.

By proceeding on this plan, getting away stage after stage in successive portions, the safety of the miner is abundantly provided for, his labour considerably spared, as will be shown by the comparative estimates of costs, and the valuable stratum of the *ten yard coal* cleared and drawn out, with a vast diminution of loss in small slack and waste; without leaving any ungot masses in the form of pillars or ribs, except those which support and strengthen the shafts; and without driving any more roads than those given in our plan as taking the form of the letter T. The timber used to support the roofs while the miners are holeing the coals, and while the roof is being made safe by means of the slack pillars, is moved onward from time to time, as the work proceeds; so that the same timber may be used during the working out of the entire coal. Some of it will doubtless be lost and injured by breaking under the weight of the coal, but the total expense of timber would not in all probability

add more than 1d. per ton to the cost of the coal, lumps, and slack, got out of the pit;—and those who are conversant with mining operations will be fully aware that the working of the coal always provides sufficient slack waste and refuse for the building up of the necessary pillars or cogs,

The economical result of getting the ten yard coal by *long work*, as to quantity, is therefore of three kinds:—1. The getting out of those masses that are left in the form of ribs and pillars, when got in stalls;—2. The comparatively small waste produced by *holeing* only *one yard* under, compared with that caused by holeings of two or more yards wide;—and 3. The avoidance of *cuttings* altogether, or to a considerable extent; and the diminished width and consequent diminished waste, when they are needed, owing to their being, like the holeings, only one yard deep.

COMPARATIVE COST OF GETTING BY LONG AND SQUARE WORK.

In estimating the cost of getting the coal by THE SQUARE, it must be taken in lengths of eight yards, that being the average width of the stalls, or the space from pillar to pillar, or from rib to pillar. It must also be borne in mind that the coal is holed under, say two yards in width,

and that perpendicular cuttings are required against the face of each rib or pillar bounding the stall. Then, taking the average height of the thick coal, with its partings, at 9 yards 1 foot 6 inches, it follows that the two *cuttings*, right and left, for the *holeing* of 8 yards long and 2 yards wide, would be each 9 yards 1 foot 6 inches high, by 2 yards wide, making a total of 38 yards of cutting, which, reckoning 4 yards as a day's work, would be 9½ days work, at 4s. 9d. per day,* £2 5 1½

The expense of holeing may be thus estimated:—

The *head* of 1 yard square to lead the holers, is first driven. Two yards of this head will be a day's work, ...	0	4	9
The other 7 yards in length and 2 yards wide, or 14 yards of holeing, at 4 yards per day, would be 3½ days, at 4s. 9d.	0	16	8
Total of holeing 8 yards long and 2 yards wide	1	1	5
Expense of cuttings as above.....	2	5	1½
Total of holeing and cutting	£3	6	6½

The coal produced by the above work may be calculated as follows, taking the measures of the thick coal, at their usual average thickness:—

* This includes the expense of liquor, candles, and sharpening of pikes.

	Yds.	Ft.	In.
Total height of the measures.....	9	1	6
Thickness of partings	0	2	3
Net height of coal.....	8	2	3

These 8 yards 2 feet 3 inches, or 8¼ yards high by 8 yards long, and 2 yards wide, give a total of 140 cubic yards,—which may be calculated to produce, exclusive of waste :—

Large coals .....70 ton.
Lumps .....14 ton.
Slack .....21 ton.

And, laying, as is usual, the whole expense of holeing and cutting,—£3 6s. 6½d.—upon the 70 tons of large coal, and nothing on the lumps or slack; it gives as the cost of *getting down* such large coal, exclusive of the expense of boys to carry away the slack made by the holers and cutters,—per ton, 11¼d. within a small fraction.

The subsequent expense of turners-out, boys, horses, and all other assistance requisite to break the coal, load the skips, and convey the whole from the working stall to *the bank*, being perhaps 100 yards or more within the mine, and a like distance on the surface, may be taken for the large coal, at per ton, ...£0 1 5

Cost of getting down, as above 0 0 11¼

Total expense of the large coal got in square work, and including the loading and drawing £0 2 4½

This amount will be found referred to in the comparative estimates ;—page 56.

The expense of getting being laid on the large coal, the charges on the lumps and slack are confined to the loading and drawing out;—say

Lumps, per ton, *got in square work*	£0	1	2
Slack, ditto, *ditto*	0	1	6

The produce and cost of getting by LONG WORK, requires a more detailed account, as the particulars of each stage or section must be taken. The thickness of these stages is regulated by the recurrence of the *partings*, and it is generally found that two or three contiguous measures, as the case may be, form a stage or section of convenient thickness.

1. The first portion taken, commences of course at the bottom of the thick coal stratum, and includes the two lowest beds, namely, the *Humphries*, which is 2 feet 6 inches thick, and the *Slipper*, which is 3 feet 4 inches thick; total 1 yard 2 feet 10 inches.* Under these, in the faces, C E,—D F, figure 5, the miners should hole 6 yards long and 1 yard wide. This will be effected by one man in one day's work of nine or ten hours, of which the cost in wages, including ale, candles, and sharpening of tools, 3s. 6d. Five sections of similar length, or a total of 30 yards, would of course cost 0 17 6

Carried forward...£0 17 6

---

* These measurements of thickness are taken from the Deepfield mine, near Tipton, in the parish of Sedgley, of which see the *Section*.

Brought forward...	£0	17	6
This line of *holeing* would require six perpendicular *cuttings*, which would occupy two days	0	7	0
To blow down and brush the coal contained in the 30 yards;—to construct the pillars or cogs of slack, and set the timbers to support the roof, would occupy three days work, of 12 hours per day, at 4s.....	0	12	0
The loading and drawing would be	2	5	0
Total...	£4	1	6

This 30 yards of coal, 1 yard 2 feet 10 inches thick, would produce—

Coals.. .. ...30 ton, at 2s. 3d.	£3	7	6
Lumps ..... 6 ... ... .1s. 2d.	0	7	0
Slack..... 9 .....1s. 0d.	0	9	0
Total...	£4	3	6

2. The Humphries and Slipper being cleared away from the entire portion or space of 10 yards wide, C E m l, and D F i k, figure 5,—or E in the section, figure 6,—the work is continued into the next portion, n, o, p, q, figure 5, or D 1, figure 6; and at the same time a second or ascending range is begun upon, as D 2, figure 6. This would include the *Sawyer* 2 feet 6 inches thick; and the *Patchel* 2 feet. Total 4 feet 6 inches. This coal being supported on the pillars of slack or *gob*, thrown

up during the first working, the holeing is rapidly effected. A single miner would probably complete 15 yards per day; but reckoning his day's work at 12 yards, and taking the line in the usual section of 30 yards long, the holeing would occupy 2½ days, which, at 3s. 6d. per day, would amount to £0 8 9

The cutting also must be continued in each ascending face of work, till the weight of the upper measures causes them to make their resting place on the piles of slack. The cutting of this second face may therefore be taken as the first, at 0 7 0

The blowing down, brushing, and cogging the 30 yards, may also be taken as before, at three days, 4s. per day ... 0 12 0

1 7 9

Loading and drawing out 1 14 0

Total...£3 1 9

The produce of the 30 yards of sawyer and patchel, would be—

Coals.....22 ton 10 cwt. at 2s. 2½d.....£2 9 7
Lumps ... 4 ... 10 .....1s. 2d. 0 5 3
Slack..... 6 ... 15 .....1s. 0d. 0 6 9

Total...£3 1 7

The coals got from this and from each of the other

ascending ranges, are conveyed down descending or inclined roads constructed for the purpose, and leading from the successive workings, respectively, to the gate road, along which the skips proceed to the shaft.

3. This second *face* of *coal* being brought down, the next workings would be C 1, C 2, C 3, figure 6, the latter of which spaces would include the *Stone Coal*, 1 yard thick; and the *Top Slipper* 2 feet thick, total 5 feet. These strata being holed, cut, and blown down, as just described, would require the same amount of labour as in the last case for holeing, cutting, brushing, and cogging;—namely £1 7 9

The quantity being rather larger, the loading and drawing out would be... 1 17 6

Total...£3 5 3

The following would be the produce of the 30 yards, and its cost—

Coals...	..25	ton	0	cwt. at	2s.	1d.	£2	12 1
Lumps ...	5	...	0	.....	1s.	2d.	0	5 10
Slack.....	7	...	10	.....	1s.	0d.	0	7 6

Total...£3 5 5

4. The fourth face of work, B 4, figure 6, would include the *Foot Coal* 2 feet 6 inches, with the parting 2 inches, and the *Brazil Coal* 3 feet 6 inches; total thickness of coal 6 feet;—the lower workings being each pushed on, *towards the shaft*, into B 1, B 2, B 3. Of this fourth range the expense for 30 yards would be—

Holeing, cutting, brushing, and cogging, as before £1 7 9
Loading and drawing out 2 5 0

Total...£3 12 9

The produce as follows:—
Coals.....30 ton, at 1s. 10½d. £2 16 10
Lumps ... 6 ton, at 1s. 2d. 0 7 0
Slack..... 9 ton, at 1s. 0d. 0 9 0

Total...£3 12 10

5. The fifth and last face of coal, A 5, figure 6, would take the *Tow Coal* 2 feet, and the *White Coal* 3 feet thick. Total 5 feet. The miner still continuing to hole in the gob or slack, and to get out equal distances in the lower measures, as is shown in the section figure 6, A 1, A 2, A 3, A 4. The expense of getting this highest division, may be taken as similar to the third stage;—namely—

Holeing, cutting, brushing, and cogging, £1 7 9
Loading and drawing out 1 17 6

Total...£3 5 3

The produce of 30 yards being—
Coals.....25 ton 0 cwt. at 2s. 1d. £2 12 1
Lumps ... 5 ... 0 .....1s. 2d. 0 5 10
Slack ..... 7 ... 10 .....1s. 0d. 0 7 6

Total...£3 5 5

The following table brings into one view the preceding statements of thickness and cost of the coal.

Heights of the several faces of Coal.

	Yd.	Ft.	In.	Cost per Ton.
No. 5	1	2	0	0 2 1
— 4	2	0	0	0 1 10¼
— 3	1	2	0	0 2 1
— 2.	1	1	6	0 2 2½
— 1	1	2	10	£0 2 3
Total thickness of coal	8	2	4 Stages, 5)	0 10 6¼
Average price *per ton* of large coal by long work, nearly				£0 2 1¼

Thus the price per ton of the large coal, got by the square, taking the average of the whole height of the ten yard coal, as shown in page 50, is..... £0 2 4¼

If got by long work, as above 0 2 1¼

Balance of cost in favour of the long work..... £0 0 3¼

With respect to the comparative quantities raised on the two systems, the following totals may be offered as not far from the truth; they are drawn from data which are universally received as the basis of such calculations. We add, at the same time, the amounts to be realised from the royalty on the two modes of mining, respectively.

Produce of the TEN YARD COAL, per acre, and the royalty on the same,

If got by long work :—

	Tons.	Royalty per Ton.	Amount of Royalty per Acre.
Coals	20,974	£0 1 7	£1660 8 10
Lumps	4227	0 0 10	176 2 6
Slack	6292	0 0 8	209 14 8
		£0 3 1	£2046 6 0

If got by the square or usual mode of work :—

	Tons.	Royalty per Ton.	Amount of Royalty per Acre.
Coals	10,400	£0 1 7	£823 6 8
Lumps	1733	0 0 10	72 4 2
Slack	3267	0 0 8	108 18 0
			1004 8 10

Balance of royalty per acre in favour of the system of long work, being more than double the amount realised by square work £1078 1 6

Such is the nature and such the result of the proposed mode of getting the ten yard coal by "LONG WORK." Its advantages, both to the mine proprietor and to the person who works the mine, are great and obvious; and when the rapid consumption of the coal of the district is considered, the question of the feasibility of this plan assumes an aspect of high importance. From long experience in the mining operations of different districts, and from actual proof to a certain extent, we have no hesita-

tion in asserting that this improved mode might be generally adopted in the valuable thick beds of South Staffordshire, both of the upper and lower mines; that its result would offer the enormous increase of produce and of royalty which we have stated, and would likewise ensure the actually increased safety of the workmen. This latter consideration alone ought to have its weight with every humane mind. In all operations which are entered on with the hope of profit to the speculator, the safety and health of the individuals employed ought to be ever a matter of prime importance; and no mode of action ought to be adopted, no changes ought to be attempted as improvements, which may by possibility involve any danger, which can by any other course be avoided.

It may be anticipated that many practical men, from long habit, and from an instinctive attachment to established forms, may be inclined to raise objections against the plans above detailed; but we feel convinced that such objections would be easily answered were the inquiry fairly entered on. A blind devotion to precedent, merely because of its long continuance, is by no means the feature of an enlightened age like the present, in which every branch of commerce and of science is marked by characters of boldness, research, and decision:—and the capitals at stake in mining undertakings, are sufficiently large to confer importance on every subject connected with these pursuits, and to induce persons of wealth and influence to give full scope and encouragement to every proposed improvement which may, eventually, so considerably affect their own interests.

THE LOWER COAL MEASURES.

HAVING thus detailed the mode of getting the thick coal, and given copious statements of the produce and cost of working its measures, we proceed to a similar account of the lower strata.

Of these the first is the HEATHEN COAL, which varies in thickness in different parts of the country, from 2 feet 3 inches to 3 feet 4 inches;—its thickness being apparently affected by the faults, which, traversing the country in different directions, but chiefly from east to west, interrupt the continuity and vary the produce of the mines.

This coal, like the brooch, should be holed under, one yard;—and if it lies on the fire-clay or basses, as is generally the case, and not on a hard rock, the holeing should be performed in that measure, thus avoiding the waste of the coal. One man will be able to hole in one day six yards in length, in the fire-clay, owing to its softness, and two men will brush and cog 30 yards long per day. This heathen coal, when holed, generally descends by its own weight, so that *cuttings* are not required; a length of 30 yards will therefore require in clearing out, the following amount of labour:—

Five holers, at 3s. 3d. per day	£0	16	3
Two men to brush and cog, 3s. 9d.	0	7	6
Loading and drawing out	1	2	6
Total...	2	6	3

The produce being :—

Coals...	..15 ton	0 cwt. at	2s. 7d.	.....	£1	18 9
Lumps	... 3 ...	0	1s. 2d.	.....	0	3 6
Slack.....	4 ...	10	1s. 0d.	.....	0	4 6
				Total...	£2	6 9

The RUBBLE COAL is 4 feet 6 inches thick, but it is of very inferior quality, and as we have never known an instance of its being raised, no calculation of its value or of the expense of getting it are offered.

The SULPHUR COAL is one yard thick, but is also considered as of little value on account of the large quantity of sulphur it contains, and from which it derives its name. It is therefore seldom or never raised.

The next stratum or rather assemblage of strata of coal, is a valuable and important one;—the NEW MINE COAL. Of this there are several beds very near together in the order of stratification; with partings of different thicknesses between them. The whole range, of something less than 8 yards in height, is therefore worked together.

This coal and its attendants, as shown in the section before referred to,—that of the Deepfield mine,—are as follow :—

	Yd.	Ft.	In.
Top coal.....	2	0	0
Parting	1	1	0
Fire-clay coal	1	2	0
Parting	0	1	8
Coal	0	2	0
Parting	0	2	0
Coal	0	1	6
Total...	7	1	2

This range of coal and other matter, may be considered as greatly resembling the principal or *ten yard* stratum, and the coal is usually got, like the ten yard coal, in *stalls;* leaving pillars to support the roof. The consequence is the same,—the loss of vast quantities of coal left in the mines untouched; the great waste occasioned by cutting away much excellent coal into slack, and the unnecessarily increased expense of wages. We shall therefore briefly detail the successive operations which would be available for the clearing of these beds by "long work," the plan being, generally, similar to that described in reference to the thick coal.

1. The miner should hole 30 yards in length and one yard wide, under the lowest bed, or *eighteen inch coal,* and bring down, with that bed, the *parting* above it and the *two foot coal,* making in the whole a face of work of a total thickness of 5 feet 6 inches.

To get out 30 yards of this face of work, would cost in wages as follows:—

Five holers, one day each, 3s. 3d....	£0	16	3
Three brushers, coggers, and movers of the *clod* or parting, 3s. 9d.....	0	11	3
Loading and drawing out	1	6	6
Total...	£2	14	0

The coal produced, being a total of 30 yards in length and 3 feet 6 inches thick, exclusive of the parting, would be:—

Coals...	17 ton 17 cwt. at 2s. 6d.	£2	4	8
Lumps ...	3 ... 10	1s. 2d.	0	4	1
Slack.....	5 ... 5	1s. 0d.	0	5	3
	26 ... 12	Total...	£2	14	0

2. This face of work being got, as in the case of the ten yard coal, to a width of 8 or 10 yards, the remaining section should be commenced. In order to which, the 20 inch parting should be first holed out; and the *Fire-clay* coal, 5 feet thick, the parting 4 feet thick, and the *Top Coal*, 6 feet thick, would then form one deep face of work, which however might, without any real difficulty, be brought down at once. Thus nearly the whole of these valuable beds would be got out, and the cost of working 30 yards long and 1 yard under, would be :—

Five holers, at 8s. 3d. per day	£0	16	3
Four cutters, 3s. 3d.	0	13	0
Four brushers and coggers, 3s. 9d.	0	15	0
Loading and drawing out	4	2	6
Total...	£6	6	9

The produce of 30 yards, having a total thickness of 3 yards 2 feet of coal, would be :—

Coals.....	55 ton	0 cwt.	at 1s. 9d.	£4	16	3
Lumps ...	11 ...	0	1s. 2d.	0	12	10
Slack.....	16 ...	10	1s. 0d.	0	16	6
	82 ...	10	Total...	£6	5	7

At a short distance below this assemblage of coal, and passing by some ironstone strata, we arrive at a bed of fire-clay, upwards of 3 yards thick, immediately under which occur the BOTTOM COAL MEASURES. These consist of :—

	Yd.	Ft.	In.
Bottom Coal	2	0	0
Parting	0	2	6
Coal	1	0	6
Total thickness...	4	0	0

These coals again, should unquestionably be got on the plan of long work, and not in stalls, which might be effected in the following manner:—

The miners should first hole one yard under the 3 *foot* 6 *inch coal*, and get it down with the parting of 2 feet 6 inches; building up the cogs, with the material thus afforded, to support the *two yard coal*. This being done to a convenient distance, the workmen should then cut upwards, between the cogs, through the *two yard coal*, which would thus be entirely brought down, the fire-clay roof being supported, as the work proceeds, by new cogs or pillars, which might be placed at such distances as the clay would permit;—generally about 6 yards from pillar to pillar.

The labour and cost of clearing 30 yards per day, of these measures, may be thus stated:—

	£	s.	d.
Five holers, at 3s. 3d. per day	0	16	3
Five brushers and coggers, 3s. 9d.	0	18	9
Loading and drawing out	3	7	6
Total...	£5	2	6

The produce being:—

Coals	45 ton	0 cwt.	at 1s. 8d.	£3	15	0
Lumps	9 ...	0 ...	1s. 2d.	0	10	6
Slack	13 ...	10 ...	1s. 0d.	0	13	6
	67 ...	10	Total...	£4	19	0

WAGES AND CONTRACTS.

It may not be improper here to remark, that the various data and calculations, as to the quantity of labour required in effecting a given portion of work;—the result of that labour, in produce,—and the prices per ton of the coals, lumps, and slack, as dependent on the labour, are all deduced from long personal observations and experience, and not in any case drawn from the statements and calculations previously made by others.

The prices or wages of labour quoted, may be taken as fair average rates; and their application is not affected by any variations of wages paid under different circumstances and in different places; because, should the price of getting be increased or diminished, the produce being the same, the cost price of the coals must be taken at a proportionably increased or diminished ratio. The prices given may therefore be considered as a species of *par*,—and as forming a basis for calculations under every varying aspect of the labour market.

In working the mines of this district, the profit on the labour of the miner is divided, and consequently *his* wages are kept low. The holders of mining property are either *proprietors*, or *lessees* on what is called ROYALTY, that is, an agreement to pay to the actual proprietor, instead of fixed rent, a given sum on every ton of mineral raised; the payments being usually made quarterly. In either case the holders are accustomed to

set or lease out the getting of the mines of coal and iron-stone, to persons who contract to find workmen and whatever is requisite to carry on the work within the pit;—as horses, skips, pikes, and timber; the labour requisite for the excavation of gate roads and air heads, &c. The total of these charges is designated as "dead work;" and is reduced to an average, which, in calculating the cost, is laid upon each ton of produce, as will be seen in the recapitulatory tables, which we shall present. The shafts themselves are sunk at the expense of the *holder*, who also bears the charges of additional sinking when the lower measures are to be worked; and who provides clerks and other necessary attendants at the surface,—engines, ropes, iron work, timber for surface-work, rails, and every species of apparatus and assistance for conveying the coals from the pit's mouth, to the boat or waggon in which they are to be conveyed.

The persons who thus undertake to work the mines by contract, are commonly known by the name of *Butty Colliers* or *Charter Masters*.* It is of course natural

* The contractor is called a *Charter-Master*;—his contract is a *Charter*, and the profit to the lord of the soil is a *Royalty*. These terms, surviving to the present day, seem to refer to some condition of the property in mines, different from the present;—to a time when the King, as is still the case in some countries, claimed as his right, the mineral produce of the land;—when he granted to the owner of the surface, or to other persons, a *Charter* to work the mines; while he himself received a share of the proceeds, in what was, then, *literally* a ROYALTY;—a tax, *ad valorem*,—paid to the royal claimant of the minerals.

that such persons should endeavour to make the best possible bargain for their own interest, by keeping the price of coals as high as possible, and bringing down the rate of wages to its lowest ebb. This is the inevitable result of the feeling of self-interest, which must guide every person who is engaged in trading occupations; and so long as the custom of contract-working continues, this vicious action of the principle must prevail, and its tendency must necessarily be the constantly lowering the condition and reducing the comforts of the working people; and the waging a perpetual war between them and their employers, according as the varying state of the market authorizes complaints of oppression, alternating with disorganizing strikes and *turn-outs*.

It is hardly possible for a person with an inquiring mind to make his observations through our mining district, without perceiving, that, considering the severity of the labour, the workmen are but indifferently paid. Men who engage in an employment, which, to a certain extent, places life and limbs in constant peril; who, during a considerable portion of the year, literally never see the light of the sun above one day in the week; ought to be enabled to earn such wages as should enable them and their families to enjoy every reasonable comfort.

Were the operations of mining so conducted, that the *miners themselves*, for a certain remuneration, paid to them *directly*, by the holder or speculator, without the intervention of the "middle-man," should agree to get the coals down,—and with proper provision of horses and apparatus, to deliver them on the bank or into the boat, —their increased earnings would quickly induce in the

sober and honest workman the desired change and improvement in his circumstances. For it is to be considered, that with proper attention on the part of those who have the management of the works, the prospect of increasing wages might be gradually made to produce increased good conduct. The labourer, possessing the means of superior comfort, would be able to enjoy, with higher relish, the pleasures of domestic life, and the delights of that home which is, at present, so often—from the scantiness of his earnings,—destitute of those accommodations which justice would accord to those who constantly incur the hazard of personal injury. It is besides to be observed, that a great proportion of the accidents that occur in mines, arise partly from the ignorance of the workmen in not judging correctly of the safety of the place into which they venture,—and partly from their eagerness to gain a little increase of pay by venturing into ill-secured spots;—both of which causes would almost entirely cease to act if the regular wages advanced; and if the moral and intellectual faculties of the population were carefully developed;—for the workmen, duly respecting their own safety, would not heedlessly rush on danger; and, feeling more independent, would not be so anxious to increase their emoluments by acts of imprudent exertion.

Again, it must be noted, that the *contractors* or *butties*, are too commonly persons of low moral feelings and depraved manners, whose object is to maintain themselves in ease and luxury by the labour of the poor miners. Their prevalent habits of intemperance and expensive indulgence, oblige them to assume a hard and

severe deportment towards those who work under them; and induce a disposition to grasp at every advantage which their avarice, ministering to their debased pleasures, can point out.

These remarks must be received as they are offered, free from all personal allusion, but as coming from one who, having spent a large portion of a life now drawing towards its close, in active employment and in close observation, in the mining district, would conceive that his duty was imperfectly and incompletely performed, if he hesitated to declare freely, the defects he observes, either in the mode of obtaining possession of the mineral produce, or in rewarding the labour of those who raise them to the light of day; and he cannot forbear thus testifying his ardent wishes that some mode of action might be arranged, which should tend to elevate the character of each section of those employed. The useful LABOUR OF THE MINERS is necessarily severe, and to a certain extent, revolting, but this very circumstance should render the philanthropist only the more anxious for the adoption of any measures that might alleviate its inherent hardships.

THE IRONSTONE MEASURES.

WE now proceed to give an account of the cost of getting the produce of the IRONSTONE MEASURES, still making the Deepfield mine, as far as it has been worked, our precedent.

Ironstone is found either in a continuous stratum, in which it is called *flats*; or else in detached masses, known as *gubbin*, *balls*, *cakes*, and *penny-stone*, which are found embedded in a matrix of earthy or clayey matter, known by the name of *bass* or *clunch*. Some of these masses, when examined, are highly curious, exhibiting, distinctly, the action of fire in their formation; sometimes displaying, when broken, a granulated fracture formed of lines radiating from a centre; and sometimes consisting of a solid crust enclosing a number of regularly formed crystals; as though the exterior of the ball or nodule had hastily cooled, leaving the interior still in a high state of temperature, and of consequent expansion. The gradual refrigeration would then, it may be presumed, cause a collapse of the particles, thus producing the spaces between the several crystallized forms.

Ironstone is got, like the thin measures of coal, by driving a head to the extent of the working, and then holeing, in lengths, towards the shaft, supporting the roof with cogs composed of the surrounding earth and other waste, assisted when necessary by timber. (See figure 3.)

The first measure of this ore which is raised in South Staffordshire, is the BLACK GUBBIN ironstone. This occurs at a short distance *below* the thick coal. The thickness of this stratum varies in different situations. At the mine of which we have spoken it is four feet; and one yard of surface measure, is calculated to produce about 5 cwt. of ironstone.

Taking the working of this measure in sections of 30 yards each, to be cleared in one day; the following will be the nature and the cost of the labour; one man holeing per day about 7½ yards in length, but only three quarters of a yard under; as strata of this description are not sufficiently cohesive to admit of more extensive excavation.

Four holers, as 3s. 3d. per day	£0	13	0
Two brushers and coggers, 3s. 9d.....	0	7	6
Loading and drawing out	0	10	9
Timber and tools	0	1	6
Total...	£1	12	9

The produce of the length of 30 yards of three quarters of a yard wide, is of course equal to 22½ yards of one yard wide, which at 5 cwt. per yard, will be:—

5 ton 12 cwt. 2 qrs. at 6s. 6d. per ton ...	£1	16	6

The next measure is the NEW MINE ironstone, which is 3 feet thick. In this stratum the same workman usually holes, and builds or cogs up his *clod*, as the refuse matter is often termed. His day's work is 3½ yards

per day, holed under, like the last measure, three quarters of a yard. A single brusher dispatches in one day, the entire length of 30 yards.

The expense of labour is then:—

8½ holers, at 3s. 3d. per day	£1	7	7
One brusher	0	3	9
Loading and drawing out	0	12	6
Total...	£2	3	10

Produce of 30 yards long and ¼ yard under:—

7 ton 18 cwt. at 5s. 10d. per ton	£2	6	2

The POOR ROBIN and other lower measures, have not been worked at the Deepfield mine; they are however got from the deeper mines in the same neighbourhood, but the strata are not so productive as in some other situations. They are worked to great advantage in the Parkfield mines, near Bilston; and at other spots approaching Wolverhampton. Our following data refer to the workings of the Parkfield mines.

The POOR ROBIN ironstone measure is 3 feet 9 inches thick. It is holed under three quarters of a yard; and the labour required to clear 30 yards in length in one day, will be:—

Four holers, at 3s. 3d. per day	£0	13	0
Two brushers and coggers, 3s. 9d.....	0	7	6
Drawing out	0	13	6
Total...	£1	14	0

Produce of the 30 yards:—

5 ton 12½ cwt. at 6s. 2d.	£1	14	8

The WHITE IRONSTONE measure is 3 feet 9 inches thick. One man will hole nearly 9¼ yards in length and ¼ yard under, per day; and one man will brush and cog 20 yards per day, so that making the day's work 40 yards in length, and three quarters of a yard in width, equal to 30 *square yards*, the labour required will be:—

4¼ holers, at 3s. 3d. per day	£0	14	7
Two brushers and coggers, 3s. 9d.	0	7	6
Loading and drawing out	1	0	6
Total...	£2	2	7

The produce of the space of 40 yards long and three quarters of a yard wide, will be:—

15 ton of ironstone, at 3s. per ton	£2	5	0

The BALL IRONSTONE measure is four feet thick. One man will hole about 9 yards in length and ¼ yard under per day. To clear 30 yards in length in one day, will cost in labour:—

3¼ holers, at 3s. 3d. per day	£0	10	10
Four brushers and coggers, 3s. 9d.	0	15	0
Loading and drawing out	0	13	6
Total...	£1	19	6

The produce being:—

5 ton 12 cwt. 2 qrs. ironstone, at 7s. 1d....	£1	19	9

The LOWER GUBBIN IRONSTONE measure is 3 feet 9 inches thick. One man will hole nearly 9 yards in

length and ½ yard under, per day, and one man will brush and cog nearly 8 yards per day. The labour required to clear 30 yards in length in one day, will therefore be :—

3½ holers, at 3s. 3d. per day	£0	11	4
Four brushers and coggers, at 3s. 9d.....	0	15	0
Loading and drawing out	0	14	0
Total...	2	0	4

The produce being :—

5 ton 12 cwt. 2 qrs. ironstone, at 7s. 3d...	£2	0	9

The BLUE FLATS ironstone measure is the last and deepest of the strata at present worked in this district; it is 3 feet thick. One man will hole 10 yards per day, and one man will brush and cog the same length. To get 30 yards per day will consequently require :—

Three holers, at 3s. 3d. per day.....	£0	9	9
Three brushers and coggers, 3s. 9d.	0	11	3
Loading and drawing out	0	14	2
Total...	1	15	2

The produce being :—

5 ton 12 cwt. 2 qrs. ironstone, at 6s. 5d...	£1	16	1

The ironstone is rather thinly dispersed in some of these measures, so that the produce is seldom more than 5 cwt. to the square yard of the surface; but the quantity is variable. At the Chillington Colliery, near Wol-

verhampton, the *Blue Flats* measure produces double this weight, or 10 cwt. to the square yard of surface, which is perhaps the most abundant produce of any situation in the South Staffordshire mining district. But in these latter named mines, owing to the inclination or cropping out of the strata before alluded to, the *brooch coal, ten yard,* and *heathen* coals are wanting, the *new mine* ironstone being the first *getable* measure which occurs. (See in the CHART OF SECTIONS, the mine headed "W. Sparrow, Esq. near Wolverhampton.")

It may be also added that the mode of working differs in this part of the district, from that usually adopted. Pits are here sunk in a line at the distance of 100 yards one from the other; and gate roads are driven out from every pit, about 50 yards in length, towards the *dip* of the mine.

At the ends of the headings, A B, A B, (see figure 7) the workings commence, and are carried on at right angles, till there is a line of connexion between the entire range of gate roads; each pit having in fact, a "face of work" of 100 yards, as a b,—b c,—c d,—d e; the whole area or space being worked from the deep of the mine, up to the shafts; similar headings and workings are then repeated *above* the shafts, or up the *crop* of the mine, till, the intended area being cleared, another range of pits is sunk in the same manner, at a proper distance, and thus the whole mine is worked out.

The air circulates from one end of the face to the other; it descends by one of the outward shafts, and returns up the shaft at the other extremity; doors being placed to open and shut as may be required, in all the gate roads

of the intermediate pits, in order to check the premature escape of the current, and to force it through the entire workings.

This mode of working is most suitable to the *crop* or shallow mines, but is sometimes also adopted in those which require deeper sinking.

By this plan of work, the *Blue Flats* ironstone is procured at the Chillington mines, at 2s. 9d. to 3s. per ton; —the produce being, as before stated, 10 cwt. to the square yard of surface.

RECAPITULATORY TABLES.

HAVING given in detail, the various statements of produce and expense of getting each separate measure, we shall now present a series of Tables, recapitulating and condensing the various scattered data, in reference to the expense of getting,—the total cost of the coal and ironstone; including *royalty* and *dead-work*;—the thickness of the measures,—produce per acre,—profit, &c.

TABLE I.—COAL.

The average expense per ton, of getting the various COAL MEASURES :—

	Coals.		Lumps.		Slack.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Brooch.....	4	3	1	2	1	0
Flying Reed	2	6½	1	2	1	0
Thick Coal	2	4	1	2	1	0
Heathen Coal.....	2	7	1	2	1	0
New Mine Top and Fire-clay Coal...	1	10½	1	2	1	0
New Mine Bottom Coal	1	10½	1	2	1	0
Measures...6)	15	5½	7	0	6	0
Average per ton	2	7	1	2	1	0

TABLE II.

The total cost per ton of the coal of each measure:—

	Coals.		Lumps.		Slack.	
BROOCH.	s.	d.	s.	d.	s.	d.
Getting	4	3	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	0	9	0	10	0	3
Profit	1	0	1	0	0	0
Total...	8	0	5	0	3	3
FLYING REED.						
Getting	2	7	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	1	5	0	10	0	3
Profit	1	0	1	0	0	0
Total...	7	0	5	0	3	3
THICK COAL, got with pillars and ribs:—						
Getting	2	4	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	1	6	0	10	0	3
Profit	2	2	1	0	0	0
Total...	8	0	5	0	3	3
THICK COAL, got on the plan of long work:—						
First range	2	3	1	2	1	0
Second ditto	2	2¼	1	2	1	0
Third ditto	2	1	1	2	1	0
Fourth ditto	1	10¼	1	2	1	0
Fifth ditto	2	1	1	2	1	0
Carried over ..	10	6¼	5	10	5	0

TABLE II. continued.

THICK COAL, long work, brot. over	Coals. s.	d.	Lumps. s.	d.	Slack. s.	d.
Ranges...5)	10	6¼	5	10	5	0
Average cost of getting, per ton ...	2	1¼	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	1	6	0	10	0	3
Profit	2	3	1	0	0	0
Total...7	10	1¼	5	0	3	3

HEATHEN COAL.

Getting	2	7	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	1	6	0	10	0	3
Profit	1	11	1	0	0	0
Total...8	0		5	0	3	3

NEW MINE TOP and FIRE-CLAY COALS.*

First range	2	6	1	2	1	0
Second ditto	1	9	1	2	1	0
Ranges...2)	4	3	2	4	2	0
Average cost of getting, per ton, ...	2	1½	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	0	10	0	10	0	3
Profit	1	6	1	0	0	0
Total...6	5½		5	0	3	3

TABLE II. continued.

NEW MINE BOTTOM COAL.*

	s.	d.	s.	d.	s.	d.
Getting	1	10½	1	2	1	0
Dead work	2	0	2	0	2	0
Royalty	0	10	0	10	0	3
Profit	2	0	1	0	0	0
Total...	6	8½	5	0	3	3

TABLE III.

The thickness of the various strata of getable COALS, *exclusive of the* PARTINGS,—and the produce per acre of each measure :—

	Thickness. Yd.	Ft.	In.	Coals. Tons.	Lumps. Tons.	Slack. Tons.
1 Brooch coal	1	0	9...	1815..	363...	1452
2 Flying reed	1	1	0...	3226...	645...	968
3 Thick coal.....	8	2	3...	10,400...	1733...	3267
4 Heathen coal... ..	1	0	0...	2420...	484...	726
5 New mine top & bottom coals...	4	2	6...	11,695...	2339...	3508
6 New mine bottom coal	3	2	6...	9275...	1855...	2782
Total thickness	21	0	0			
Total quantities, the thick coal being got with ribs & pillars				38,831...	7419...	12,703
Additional, if the thick coal be got by long work.....				10,574...	2494...	3025
Total quantities, if got by long work				49,405...	9913...	15,728

* See note on the cost of these and the other new mine coals, following table 6.

TABLE IV.—IRONSTONE.

The cost, per ton, of each IRONSTONE MEASURE, on the calculations already given :—

	Getting.		Dead-work.		Royalty.		Profit.		Total Cost.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Thick coal gubbin ironstone	6	6	2	6	1	6	1	6	12	0
New mine ditto	4 6 to 5 10		2	6	1	6	1	6	10	0
Poor robin ditto	6	2	2	6	1	6	4	4	14	6
White ironstone	3	0	2	6	2	0	8	0	15	6
Ball ditto	7	1	2	6	2	0	3	11	15	6
Gubbin ditto	7	6	2	6	2	0	3	6	15	6
Blue flats ditto	3	0	2	6	2	0	8	0	15	6
Measures..7)	37	9	17	6	12	6	30	9	98	6
Averages per ton	5	5	2	6	1	9½	4	5	14	1

TABLE V.

The produce per surface yard and per acre of the ironstone measures :—

	Produce per Sq. Yd. *Cwt.*	per Acre. *Tons.*
Thick coal or top gubbin ironstone...	5 ...	1210
New mine ditto	7 ..	1694
Poor robin ditto	5 ...	1210
White ironstone	10 ...	2420
Ball ditto	5 ...	1210
Lower gubbin ditto	5 ...	1210
Blue flats ditto	10 ...	2420
Total...	47	11,374

TABLE VI.

Royalty and profit of each measure of coal and iron-stone. If got out at the rate of 2 acres per annum, with the value per acre for present payment.

Coal.	Royalty per Acre. £	s.	d.	Profit per Acre. £	s.	d.	Value per Acre. present payment. £	s.	d.
Brooch coal...	101	6	6...	108	18	0..	52	0	6
Flying reed...	267	10	2...	193	11	0...	137	6	10
Thick coal ...	893	0	10...	1213	6	4...	458	10	10
Heathen	210	14	10...	256	2	0...	107	8	0
New mine top and fire-clay coal*	628	12	0...	994	1	6...	322	15	2
New mine bottom* ...	498	10	6...	1020	5	0...	255	19	5
Totals on the coal carried to the next page	2599	14	10...	3786	3	10...	1334	0	9

* * It is necessary here to remark, that these sums, and those in Table 2, in reference to the *New Mine Coals*, are rather what might be produced, than what actually are realized. They refer to the results of *long work*, whereas, in almost all instances, those coals are got by *square work*, or with ribs and pillars, which adds to the wages of the workmen, from 6d. to 1s. per day; besides the diminution of the total quantity, and the increased proportion of waste and slack which yield no profit at all.

TABLE VI. continued.

Ironstone.	Roy. per Acre. £	s.	d.	Profit. £	s.	d.	Pres. Value. £	s.	d.
Top gubbin...	90	15	0...	90	15	0...	46	11	11
New mine ...	127	1	0...	127	1	0...	65	4	8
Poor robin ...	90	15	0...	262	3	4...	46	11	11
White	242	0	0...	968	0	0...	124	5	1
Ball.....	121	0	0...	236	19	2 ..	62	14	11
Gubbin	121	0	0...	211	15	0...	62	14	11
Blue flats.....	242	0	0...	968	0	0 ..	124	5	1
Totals on the ironstone	1034	11	0...	2164	13	6...	532	8	6
Totals on the coal as page 81	2599	14	10...	3786	3	10...	1334	0	9
Totals per acre on the coal & ironstone	3634	5	10...	6650	17	4...	1866	9	3

TABLE VII.

The actual quantity of coal and ironstone got per man *per day*, deduced from the statements already given in the progress of description :—

	Coals. T.	C.	Q.	Lumps. T.	C.	Q.	Slack. T.	C.	Q.
Brooch coal.....	1	4	0	0	5	0	1	0	0
Flying reed	2	10	0	0	10	0	0	15	0
Thick coal	5	0	0	1	0	0	1	10	0
Heathen coal	2	3	0	0	9	0	0	13	0
New mine top and fire-clay coals	3	9	1	0	10	2	1	0	3
New mine bottom coal	4	10	0	0	18	0	1	7	0
Strata...6)	18	16	1	3	12	2	6	5	3
Average day's getting, nearly	3	2	2	0	12	0	1	0	3

IRONSTONE.

	T.	C.	Q.
Thick coal or black gubbin ironstone.....	0	18	3
New mine ditto	0	16	2
Poor robin	0	18	3
White stone	2	6	0
Balls	0	15	0
Gubbin	0	15	0
Blue flats	2	6	0
Strata...7)	8	16	0
Average day's getting, nearly...	1	5	0

TABLE VIII.

The following were the prices per ton of coals of different descriptions, delivered into boats or waggons, at the pits, June 22, 1835; and from these prices the previous calculations of profit per acre have been constructed :—

DEEPFIELD MINE.

	£	s.	d.
Brooch coal, large	0	8	0
Lumps.....	0	5	0
Rakings	0	3	9
Slack	0	2	6
Cokes, per sack	0	1	4
Thick coal, best, per ton.....	0	9	0
Ditto, second	0	8	0
Ditto, inferior...	0	7	0
Ditto, ditto, for furnaces.....	0	6	6

TABLE VIII. continued.

	£	s.	d.
THICK COAL, lumps	0	5	0
Ditto, slack, good	0	2	9
Ditto, ditto, small	0	2	6
NEW MINE top and fire-clay coals, best	0	7	0
Ditto, for furnaces	0	6	0
Ditto, lumps	0	5	0
Ditto, rakings	0	3	6
Ditto, slack, good	0	2	9
Ditto, ditto, inferior	0	2	6
NEW MINE bottom coal, large	0	6	0
Ditto, lumps	0	4	6
Ditto, slack	0	2	6

TIVIDALE MINE,

(Part of the West-Bromwich Line.)

Thick coal, best, per ton	0	8	6
Ditto, inferior	0	6	6
Ditto, lumps	0	5	6
Ditto, slack	0	2	6

The above are the actual charges at the time and places mentioned; but the prices of all the kinds of coals vary considerably in proportion to their quality, which is by no means the same in all parts of the same district of the mines.

TABLE IX.

The dimensions and cost of driving of GATE ROADS and AIR HEADS, in the various measures of coal and ironstone;—reckoning the wages at 3s. per day, with an allowance of 6d. per day extra for drink and candles,—as paid at the Deepfield mines; with the exception of the thick coal miners, who are paid 4s. 9d. per day, including drink and candles.

GATE ROADS.

Name of Measure.	Width.		Height.		Cost per Yard.			
	Ft.	In.	Ft.	In.	s.	d.	s.	d.
Brooch coal.....	4	6 by	3	9	3	6 to	5	0
Flying reed, 4 ft. to 5		0 —	4	0	3	6 —	5	0
Thick coal	9	0 —	6	0	7	0 —	8	0
Heathen coal	4	6 —	3	0	3	6 —	5	0
Gubbin ironstone	4	6 —	4	0	4	6 —	5	0
New mine ditto ...	4	6 —	4	0	4	6 —	5	0
Ditto top coal	6	0 —	5	6	6	0 —	6	6
Fire-clay coal	6	0 —	5	0	5	0 —	6	0
Poor robin ironstone	4	6 —	3	9	4	6 —	5	0
White ditto..... ..	4	6 —	3	9	4	6 —	5	0
Bottom coal.....	5	6 —	5	6	4	6 —	5	6
Ball ironstone	4	6 —	4	0	4	6 —	7	0
Gubbin ditto	4	6 —	3	9	4	6 —	7	0
Blue flats ditto,.....	4	6 —	3	0	4	6 —	7	0

The AIR HEADS in every case are about 3 feet 3 inches square, and the cost of driving them may be taken universally at 3s. to 4s. per yard.

TABLE IX. continued.

SUNDRY DATA.

Cost of sinking pits at Deepfield, near Bilston, where the pits are usually 7 feet in diameter. The workman has from 22s. to 25s. per yard in depth, and the total expense is from £2 to £2 10s. per yard.

The capital required to open a Colliery on a considerable scale;—so as to get per week 600 tons of coals, lumps, and slack, and 300 tons of ironstone, may be estimated at from £8000 to £10,000.

It may be generally assumed, that the best of the *thick coal* of South Staffordshire, will at all times find a ready market in London, at about 4s. per ton less than the *Seaborne* or *Newcastle coals*, which, at the date already quoted in Table VIII. (June 22, 1835), were selling to the traders at 21s. per ton, and were sold by them to the public at 31s. per ton.

The expense of delivering the Newcastle coal from the colliers' vessels, lying on the Thames, at London, to the houses of the inhabitants, may be thus estimated:—

Lighterage, per ton	£0	3	0
Cartage	0	4	0
Total...	£0	7	0

This added to the cost price, 21s. per ton, gives a total of 28s. leaving 3s. as the profit per ton, on the selling price of 31s. as quoted above.

TABLE X.

The cost, per ton, of forge and pig iron, at the rate of wages and royalties given;—all made from *cold blast*:—

	Forge and Pig Iron.			Bar Iron.		
	£	s.	d.	£	s.	d.
At Shut End, in the parish of Kingswinford	4	2	9	7	2	9
At Bilston	4	3	9	7	3	9

Coal required to produce 20 cwt. of forge and pig iron:—

Thick coal,.....4 ton.....Slack, 1 ton 10 cwt.

New mine coal, 6 ton.....Slack, 2 ton 0 cwt.

Quantity of ironstone required to make 1 ton of forge or pig iron:—

Gubbin or new mine ironstone ..... 3 ton 10 cwt. or 28½ per cent.

Poor robin, white-stone, and blue flats 3 ton 0 cwt. or 33 per cent.

Refinery cinder* .....2 ton 0 cwt. or 50 per cent.

* This is a rich calx or *oxide of iron*, produced in large quantities at the principal FORGES, but is somewhat untractable, and difficult to manage.

THE LIMESTONE
OF
SOUTH STAFFORDSHIRE.

THE carboniferous or mountain limestone, known among the miners as the *blue limestone*, may be concluded, as is stated in the Geological Sketch, to extend under the coal and ironstone measures of the entire district. In the regular course of stratification a series of rocky deposits, under the name of clunch, wild measures, &c. to a thickness of 60 yards or upwards, intervenes, between the lowest ironstone measures, and the limestone formation; except where, the limestone itself, at some intermediate period of the earth's history, has been forcibly elevated, or "*thrown out*,"—to adopt the expressive term of the practical miner. When exhibited above the ordinary level, as at the Wren's Nest, near Dudley, this great deposit is found to consist of one upper or outer bed of fine "blue" limestone, about 13 yards thick;—an intermediate stratum of inferior material,—lime largely combined with clay and sand, so as not to be worth working, nearly 40 yards thick;—and an inner or lower bed of fine limestone, about 12 yards thick. A large portion of the strata at the Wren's Nest, is exhausted by means of upper workings, in the day-light;—the limestone having been got out in large halls or caverns with open spaces,—and the adjoining strata supported by occasional columns of considerable thickness, left ungot.

There are also two tiers of lower, or dark workings, conducted in a similar manner, from which the produce is either raised to the surface by whimsey engines, or removed by boats, along a subterraneous canal, cut at great cost, through the hills, and joining the Birmingham line, near the grounds of Dudley Castle. When worked as *deep mines* in other situations, the upper bed only is at present reached, but there is every probability that both strata continue under the coal field. The total thickness however is not so great as at the Wren's Nest, and may be taken at 10 yards on an average, consisting generally of ten beds, which lie closely, one on the other, without partings, but which are disposed, easily, to separate.

The entire contents of the ten yard bed of the deep limestone mines, may be estimated at 72,600 tons per acre, of which about 14,600 are necessarily left in the form of pillars; and as in getting limestone no further waste whatever is made, the quantity actually raised per acre is about 58,000 tons. It is loosened by blasting, the holes drilled in the rock being from 18 to 24 inches deep, and the whole is carried away.

The workings of the limestone at the WREN'S NEST, both above and below ground, and the general scenery of the place, present truly grand and striking spectacles. The hill, itself, with its precipitous and scarped sides, flung up by long-past earthquakes, dipping *both east and west*, at angles of 50 to 80 degrees;--and its table summit of thick copse and verdant lawn,—is a singular and picturesque object;—while the spacious caverns with which it is perforated, emulate in wild sublimity, the largest cavities left in certain situations, by the hand of

nature. The stranger dwells with unwearied surprise and interest on the apparently interminable range of arches which the industry of man has gradually scooped out in the hard and solid rock,—and on the massive columns, which, left for security, perpendicular to the lines of stratification, hang, fearfully inclined, across the yawning abysses, and give an impressive and unusual effect to the scene.

The cost of getting and drawing out to bank, the LIMESTONE, is, per ton, about	£0	1	6
Dead work	0	1	0
Royalty	0	0	6
Profit	0	1	0
Price delivered into boats, per ton...	£0	4	0

The profit on the limestone being thus presumed to be *one shilling* per ton, the total profit per acre will be 58,000 tons (as shown in the last page,) at 1s. £2900 0 0

Each man will get per day, about .....4 tons.

As the existence of the limestone under the coal measures, generally, seems unquestionable, it would appear obviously advantageous to the coal master to sink his pits down to this valuable stratum, as the burning of it into lime, for the purposes of agriculture and of building, would provide the means of consumption for great quantities of his slack; besides the additional market for the limestone as flux for the iron furnaces, if there were any in his neighbourhood.

THE NORTH STAFFORDSHIRE MINING DISTRICT.

GENERAL TOPOGRAPHICAL DESCRIPTION.

Besides the great coal basin of South Staffordshire which has been described, there is, in the northern part of the same county, another district, in which the useful and valuable minerals, coal and ironstone, are produced in great abundance. These mines occupy an area of triangular form, of which Newcastle-under-Lyme is the centre, and Mole-copt Hill the apex, to the north; the lines to the S.E. and S.W. each extending about 10 miles; the total area being about 50 square miles. The mines are worked principally at Apedale, Harecastle, and Lane End; all within a small distance of Newcastle.

The beds of coal and ironstone are numerous and rich, but the disruptions of the stratification are remarkable, and the working of the mines uncertain, irregular, and difficult. The mine strata crop in every direction, and are besides shattered and disturbed by continual faults and dislocations, so that in some places the position of the measures inclines rapidly to one point, till a sudden

alteration takes place, and they crop in an opposite direction, from eight inches to two feet in the yard, thus approaching towards the surface, till another sudden break or fault occurs, when the entire course of measures will perhaps be found, plumb down,—at an additional depth of nearly a hundred yards, but still cropping up at a considerable angle, till at length the whole range of coal strata are thrown out by the limestone which appears in certain situations, and which, in all probability, extends under the coal and ironstone beds as in the southern district, but at a depth too great to be penetrated by the miner. The section exhibited in figure 8, although imaginary, may give some idea of the position of the strata, in this very much disturbed district.

The example selected for insertion in the Chart of Sections, is a mine at Apedale, near Newcastle, the property of R. E. Heathcote, Esq. of Longton Hall, for whom the author acted as agent in the year 1830. The section of this mine shows the course of stratification, to the great and unusual depth of 715 yards, and exhibits strikingly the bold scale on which mining operations are carried on in that part of the county, where rocky beds of the thicknesses respectively of 30, 40, 60, 100, and 126 yards, are cut through in pursuit of the expected deposits of useful minerals. At Harecastle, a distance of three miles, the depth of the mines is only 325 yards, and at Lane End, 346 yards.

The coals of the mines in this division of the county, are generally found in entire strata, or unseparated by partings, or *sheds* as they are termed. The measures are of moderate thickness, and their produce is generally

of good quality for domestic use, but those of the lowest measures worked, the "seven foot Nabbs," and "eight foot Nabbs," are superior to most of the others. These coals share, with the produce of the coal-fields of the north of England, in the property of conglomerating and running together in a mass, in the course of burning, thus evincing the very great quantity of combustible matter,—hydrogen, in its various combined states,—which they contain. They throw out a very great heat, produce a comparatively small quantity of ash, and make strong good cokes for the use of the blast furnaces.

The ironstone of the North Staffordshire mines, is, generally, a rich ore,' producing from 30 to 40 per cent. of metal; the beds however vary greatly in thickness, in quality, and in price of getting. The pig-iron produced from these ironstones is of first-rate quality, but the bar iron is not usually so highly approved.

The mines of this district have been long worked. Dr. Plot, in his "Natural History of Staffordshire," gives several curious particulars relative to the strata usually raised at that period, (about 1680,) and to the mode of working them. He also speaks highly of the skill of the artificers in the neighbouring iron works, noticing especially the "secret art" of making FRYING PANS and other articles of beaten iron, as practised at *Keel*, near *Newcastle*: "So ingenious," says the Doctor, "that I thought it incredible."* But the lapse of time and the advance

* Natural History of Staffordshire, 1686, p. 335.

of manufactures and commerce, have, here, as in South Staffordshire, greatly altered both the operations themselves, and the extent to which they are carried; and the wonders of Plot sink into insignificance, when compared with the production, the demand, and the enterprize of the nineteenth century.

The Trent and Mersey Canal runs through this coal-field, and affords the means of transit for the mineral produce in every direction. Much of the pig-iron is sent to Manchester, where metal of the first quality is required; the coal is dispersed into various quarters, and large quantities are used in the neighbouring Potteries, and at the Salt Works of Cheshire.

The establishment of a Railway from Birmingham to Liverpool will also, on its completion, open a new market for the minerals of this diatrict, and it is not improbable that the best coals, the *Nabbs*, may find their way to Birmingham, and even to London, competing, by their superior quality, with the coals found in the vicinity of the former place, and those brought by sea to the latter, from the mines of Northumberland and Durham. The benefit derived from this new mode of conveyance will also be felt in the wide diffusion of cheap and excellent fuel, through various portions of the country, now suffering from the want of, or labouring under the great expense of procuring, that paramount and perpetual necessary of life.

Fig 9.

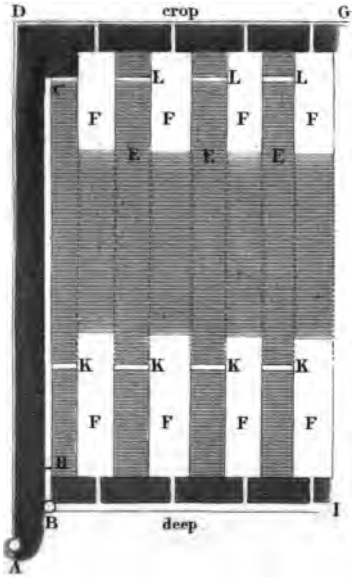


Fig 10.

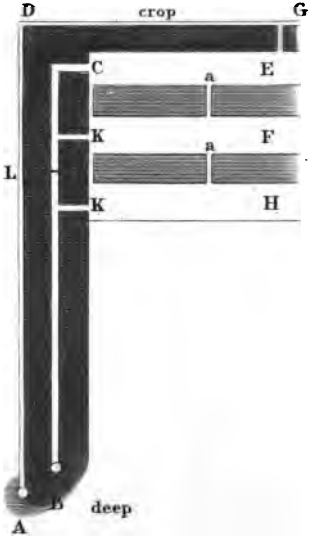
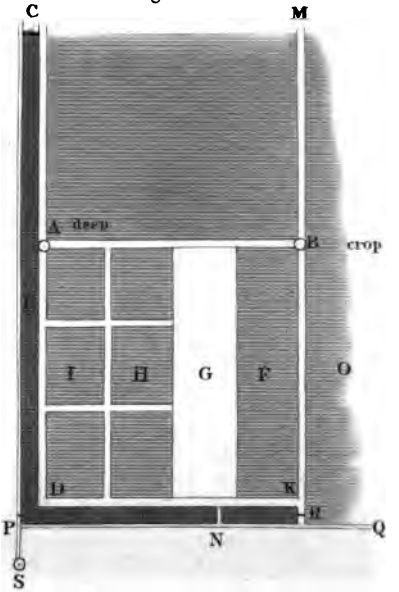


Fig 11.



MODES OF WORKING THE COAL MEASURES.

THE mode of working the mines of the North Staffordshire district, varies according to the thickness of the strata. Some of the measures are got by *long work*, in which however the miners, in most cases, leave untouched, at such distances as experience dictates, small pillars, of four to five feet in diameter, to form the main supports of the roof; and between these pillars, they build up *cogs* of batt and refuse, to ensure the safety of the work. The thicker measures, such as the TWO YARD and THREE YARD coals, are got in stalls of six yards wide, leaving intervening ribs of about four yards wide, between the stalls.

The shafts are sunk in *the dip* of the strata, and the mining work is carried on *up the crop* or ascent, in which direction the main gate road is driven. The diagram (figure 9) will more completely elucidate the mode of working.

A and B are two shafts or pits, generally full 7 feet in diameter; from one of which, B, is driven the *gate road*, B C, "up the crop" to such extent as the work prescribes, and from the other is driven the level or *air head*, A B, parallel to the gate road, but at a distance of about four yards from it, and extending again from D towards G, along the farther boundary of the work. This level also carries the water of the mine to the shaft A, from which

it is drawn up by the *water engine*. E, E, E, are the ribs of coal about four yards wide, left between the stalls, F, F, F. As much of the coal forming these ribs, is however got out, after the stalls are cleared, as is consistent with the safety of the work, till at length the small pillars of four to five feet square, only, are left, as above described. The stalls, F, F, F, are 6 yards wide, and their number of course increases as the coal is got out, till the entire mine is cleared of its produce.

A rib of coal, H C, is left throughout the length of the working, between the gate road and the first stall. Through this rib, as the work proceeds, openings are *thirled*, by which the coals are carried to the gate road, to be drawn up at the pit B. From this shaft also an air head is driven towards I.

Thus planned, the work proceeds at both ends of the proposed area, the coals from each *face of work* being drawn through their proper passages in the rib, H I, to the gate road B C. K, K, K, and L, L, L, are openings in the ribs, made as occasion requires, for conveying the coals from the farther stalls.

In this work the air descends by the pit B, and proceeds along the air head towards I,—a door being placed at H to prevent its progress in that direction;—the current then enters the stalls by the thirls in B I,—finds its way along the gate road,—through the working at the other extremity of the mine,—then along the air heads G D,—D A, till it ascends by the shaft A.

In some of these measures, the roof is bad and unsound, in which case the space or width of six yards in the stalls, will not support itself, and timbers are used to

increase the security of the mine. These timbers remain till the stalls are cleared, and also till the coal of the ribs is reduced, when they are withdrawn as far as is practicable.

When from any cause, it is most convenient to cut the stalls in a series of levels *across* the crop, or ascent,—the work is planned as in figure 10, wherein the ribs and principal levels and gate roads are placed as in the last figure, the work commencing at the farthest end, and the stalls E, F, H, cleared in succession. The coal is carried to the gate road, through the openings C, K, K, a door being placed immediately beyond the *first opening*, at E, so that the current of air is forced through all the stalls, by the thirls or passages in the ribs, a a, into the head, at G, and from thence along the head G, D, A, to the engine pit A, whence it ascends.

In this, as in the last mode of working, after the stalls are cleared, such portion of the ribs as can be worked with safety are also brought down and drawn out. This is done to a considerable extent by cogging, and by leaving small pillars standing, out of the substance of the ribs, as before described.

Our next diagram, figure 11, explains the getting of the thinner measures of coal in stalls of *long work*, as is occasionally practised. For this purpose the pits or shafts are sunk at a considerable distance, often 80 yards or upwards, one from the other.

A is the deep pit, 7 feet in diameter, and descending to the proposed stratum. B is the *crop pit* of the same diameter, and sunk so as to meet the same stratum in its

ascending slope. An air head, A B, connects the two pits, and tends to ensure the circulation of air through the work. S is the water engine, from which a level or air head is driven as occasion demands, towards C, and another in the direction P Q.

A D is the main gate road, of 5 feet in width, and of height sufficient to permit the loaded waggons or skips to pass along it; and D K, the gate road up the crop; each gate road being separated from the level or air head, by the rib E E, four yards thick. F is a rib or section of coal, 20 yards wide, left at the top of the working, or immediately below the shaft, B, but which is got out after the side of work at O is cleared. G is the first stall worked, being about 30 yards wide. It is holed by *long work*, in the manner so often alluded to, and the coals carried down the cross gate roads, to the main gate road A D, to be drawn out at the pit A.

When the stall G is cleared, another stall or section, H, is opened and worked in the same manner; and afterwards a third, as I, till the whole side of work is completed up to the air head, A B. The operation is then repeated on the other side of this gate road, till the opposite side of work, A, C, M, B, is also worked out. The narrow double lines intersecting the stalls, H, V, I, indicate the roads made by the miners for convenience in conveying the coals, during the progress of the work, to the principal gate road, but they are by no means necessary, if the work be well arranged.

Simultaneously with the working of these stalls, another face of work is opened in the crop-mine, O, and conducted on a plan similar to that already detailed,—the coals got being drawn up by the pit, B.

In a work of this description, thus carried on, in two great divisions, the following is the course of ventilation. The air enters at the water engine, pit S;—is stopped by a door at P, by which it is driven along the head, P Q. A portion of the current circulates through the stalls, G, H, I, having entered by the thirl, N, into G;—another portion proceeds in like manner to ventilate the stalls of O, its direct progress along the gate road, B B, being checked by a door at R. The two streams finally ascend respectively by the pits, A and B.

The other figure, No. 12, represents the plan of getting the thin coal, by long work, as produced at a colliery, near Lane End.

A, the engine pit, about 8 feet in diameter, well defended with brick and mortar.

B B, the level and air head, 3 feet square, extending the whole width of the mining area, perhaps some hundred yards in length; and afterwards proceeding, as the work advances, towards L L.

C, the *bye-pit*, or coal-pit, 7 feet in diameter.

D D, the gate road by which the coals are conveyed to the pit. It is about 5 feet 6 inches square, and, like the level, corresponds in length, with the width of the proposed work.

E E, the rib of coal between the gate road and the air head, 4 to 6 yards wide.

F F, openings or stalls of about 50 yards wide, or any convenient width, in which the work is begun. These stalls extend up the crop to the extremity of the proposed clearing. They communicate with the main gate road

by the openings, G G. These openings are closed up when the stalls are cleared, in order to force the air into the next workings.

H, the coal which remains to be got after F F are cleared. It is divided into stalls of convenient width, similar to F F,—ribs and air heads, as I I, intervening between each stall.

Similar workings are afterwards executed in order to get the coal from the spaces, K K, on the other side of the shaft.

In these various workings, the following may be considered as the average scale of expenditure.

The miners' *wages*, per day, are 3s. candles and sharpening of tools being allowed for, as an extra charge.

The average diameter of the *shafts* being considered 7 feet, the expense of sinking them may be taken at £2 per yard for the workman;—the total, including materials,—the pits being bricked and mortared throughout, —£2 15s. to £4 per yard.

The *gate roads* are from 4 to 6 feet wide, and in height usually corresponding with that of the measure in which they are driven,—but in no case exceeding 6 feet high. The cost of driving them varies with their dimensions, from 2s. 6d. to 6s. 6d. per yard. (See Table IV.)

The levels or *air heads*, are about 3 feet 3 inches square, and cost from 2s. to 4s. per yard in length, according to circumstances.

The *charter of the coal* is 2s. 8d. or 2s. 9d. per ton, and for the *slack* 1s. 3d. per ton;—delivered into waggons, or on the banks. There are no lumps or cobbles made from these coals.

Fig.12.

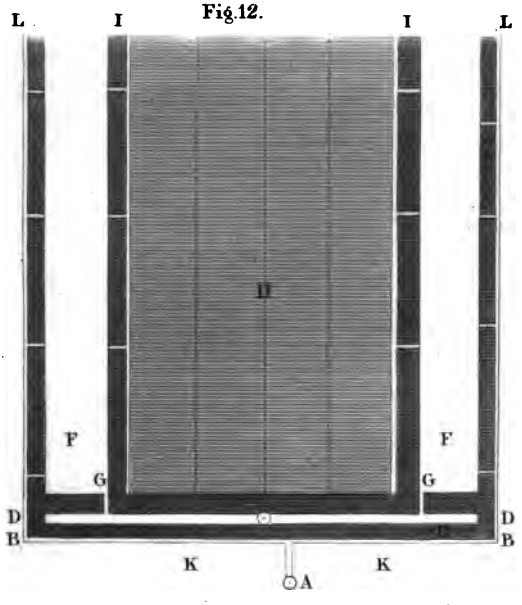
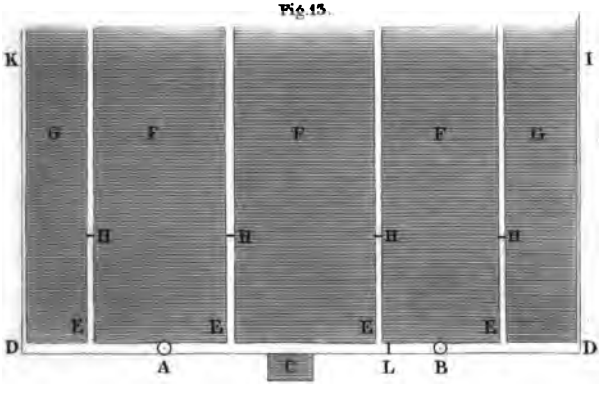


Fig.13.



We proceed to offer in a tabular form, several data relative to the cost of getting,—the royalty, profit, &c. of the coal strata of this district, referring to the Apedale mines, in the year 1830;—at which time however, the measures marked * were not worked.

TABLE I.

Names of Coal Measures.	Getting. Coals.		Getting. Slack.		Dead-work. Coals.		Dead-work. Slack.		Royalty. Coals.		Royalty. Slack.		Profit. Coals.		Profit. Slack.		Total p. ton Coals.			Total p. ton Slack.		
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	£	s.	d.	£	s.	d.
* Peacock coal	2	7			2	0			1	0			0	5			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
* Spincroft coal	2	7			2	0			1	0			0	5			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
* Great Roe coal	2	5			2	0			1	0			0	7			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
* Kennel coal.....	2	5			2	0			1	0			0	7			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
Little Roe coal	2	1			2	0			1	0			0	11			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
* Rusty Mine coal.....	2	1			2	0			1	0			0	11			0	6	0			
Ditto slack			1	0			2	0			0	7			0	0				0	3	7
Chalky Mine Rider coal...	2	10			2	0			1	0			0	2			0	6	0			
Ditto slack ...			1	0			2	0			0	7			0	0				0	3	7
Carried forward...	17	0	7	0	14	0	14	0	7	0	4	1	4	0	0	0	2	2	0	1	5	1

TABLE I. continued.

Names of Coal Measures.	Getting. Coals.		Getting. Slack.		Dead-work. Coals.		Dead-work. Slack.		Royalty. Coals.		Royalty. Slack.		Profit. Coals.		Profit. Slack.		Total p. ton Coals.			Total p. ton Slack.		
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	£	s.	d.	£	s.	d.
Brought forward...	17	0	7	0	14	0	14	0	7	0	4	1	4	0			2	2	0	1	5	1
Single 4 foot coal	2	9			2	6			1	0			0	5			0	6	8			
Ditto slack			1	0			2	6			0	6			0	0				0	4	0
* Single 5 foot coal	2	7			2	6			0	0			0	11			0	6	0			
Ditto slack			1	0			2	6			0	0			0	0				0	3	6
Ragman coal	2	4			2	6			1	0			0	8			0	6	6			
Ditto slack			1	0			2	6			0	0			0	0				0	3	6
One yard to 7 foot coal ...	2	9			2	6			1	0			1	9			0	8	0			
Ditto slack ...			1	0			2	6			0	0			0	6				0	4	0
Hams coal	2	7			2	6			1	0			0	5			0	6	6			
Ditto slack.....			1	0			2	6			0	0			0	0				0	3	6
Ten foot coal	2	4			2	6			1	0			2	2			0	8	0			
Ditto slack			1	0			2	6			0	0			0	6				0	4	0
Top two Roe coal.....	3	10			2	6			1	0			0	0			0	7	4			
Ditto slack.....			1	0			2	6			0	0			0	0				0	3	6
* Bowling Alley coal.....	2	7			2	6			1	0			0	0			0	6	1			
Ditto slack.....			1	0			2	6			0	0			0	0				0	3	6
Carried forward...	38	9	15	0	34	0	34	0	14	0	4	7	10	4	1	0	4	17	1	2	14	7

TABLE I. continued.

Names of Coal Measures.	Getting. Coals. s.	d.	Slack. s.	d.	Dead-work. Coals. s.	d.	Slack. s.	d.	Royalty. Coals. s.	d.	Slack. s.	d.	Profit. Coals. s.	d.	Slack. s.	d.	Total p. ton Coals. £	s.	d.	Total p. ton Slack. £	s.	d.
Brought forward...	38	9	15	0	34	0	34	0	14	0	4	7	10	4	1	0	4	17	1	2	14	7
Seven foot Nabbs coal.....	2	10			2	6			2	0			2	8			0	10	0			
Ditto slack ...			1	0			2	6			1	0			0	6				0	5	0
Eight foot Nabbs coal.....	2	10			2	6			2	0			2	8			0	10	0			
Ditto slack ...			1	0			2	6			1	0			0	6				0	5	0
* Grey coal.....	2	3			2	6			1	0			0	3			0	6	0			
Ditto slack			1	0			2	6			0	0								0	3	6
Strata...18)	46	8	18	0	41	6	41	6	19	0	6	7	15	11	2	0	6	3	1	3	8	1
Average COALS, nearly	2	7			2	3½			1	0½			0	11½			0	6	10			
Average SLACK, nearly			1	0			2	3½			0	4½			0	1½				0	3	9½

☞ The measures marked * were *not getting* in the year 1830.

TABLE II.

Produce and Profit per Acre,—Selling Price, &c. 1830.

Names of Coal Measures.	Thickness of the Measures.			Produce per Acre.		Profit per Acre.†			Quantity got, per man, per day.						Price delivered in Boats or Waggons, in 1830.					
									Coals.*			Slack.*			Coals.			Slack.		
	Yd.	Ft.	In.	Coals. *Tons.*	Slack. *Tons.*	£	*s.*	*d.*	*T.*	*C.*	*Q.*	*T.*	*C.*	*Q.*	£	*s.*	*d.*	£	*s.*	*d.*
Peacock coal ...	1	2	0	4840	806	100	16	0	2	6	0	0	7	2	not getting.					
Spincroft	1	2	0	4840	806	100	16	0	2	6	0	0	7	2	not getting.					
Great Roe	2	0	0	5808	968	169	8	0	2	10	0	0	8	1	not getting.					
Kennel.....	2	0	0	5808	968	169	8	0	2	10	0	0	8	1	not getting.					
Little Roe	2	1	0	6637	1106	304	3	0	2	19	0	0	9	3	0	6	8	0	3	6
Rusty Mine.....	3	0	0	8712	1452	399	6	0	2	16	0	0	9	1	not getting.					
Chalky mine rider	1	0	0	2904	484	24	4	0	1	18	0	0	6	1	0	6	8	0	3	6
Single 4 foot ...	1	2	0	4840	806	100	16	8	2	6	0	0	7	2	0	6	8	0	3	6
Single 5 foot ...	1	2	0	4840	806	221	16	8	2	6	0	0	7	2	not getting.					
Ragman	1	0	6	2904	484	96	16	0	2	14	0	0	9	0	0	6	6	0	3	6
One yard to 7 foot	2	2	6	8228	1371	754	4	6	3	7	0	0	11	0	0	8	0	0	4	0
Hams	1	2	0	4840	806	100	16	0	2	6	0	0	7	2	0	6	6	0	3	6
Ten foot	3	0	0	8712	1452	980	2	0	2	16	0	0	9	1	0	8	0	0	4	0
Top two Roe ...	0	2	0	1936	322				1	5	0	0	4	0	0	7	0	0	3	6
Bowling Alley...	1	2	0	4840	806				2	6	0	0	7	2	not getting.					
Carried forward,	28	0	0	80,689	13,443	3522	12	10												

TABLE II. continued.

Names of Coal Measures.	Thickness of the Measures. Yd.	Ft.	In.	Produce per Acre. Coals. *Tons.*	Slack. *Tons.*	Profit per Acre.† £	s.	d.	Quantity got, per man, per day. Coals.* T.	C.	Q.	Slack.* T.	C.	Q.	Price delivered in Boats or Waggons. Coals. £	s.	d.	Slack. £	s.	d.
Brought forward,	28	0	0	80,689	13,443	3522	12	10												
Seven foot Nabbs	1	2	6	5280	880	726	0	0	2	5	2	0	7	2	0	12	0	0	5	0
Eight foot Nabbs	1	1	6	4356	726	598	19	0	2	0	0	0	6	1	0	10	0	0	5	0
Grey coal..... ..	3	0	0	8712	1452				2	16	0	0	9	1	not getting.					
	34	1	0	99,037‖	16,501‡	4847	11	10												
Bull hurst ...	These measures are got at Harecastle, but not at Apedale mines.								2	6	0	0	7	2						
Wind penny									1	18	0	0	6	1						
Silver mine ...									1	18	0	0	6	1						
Under ditto ...									1	18	0	0	6	1						

† See the rate of profit per ton, in the last Table.

* * The getting, per day, is, by custom, calculated at 22 cwt. to the ton.

Amount of royalty, per acre .....
‖ On 99,037 tons of coal, if taken at 1s. per ton, (see Table I.) is £4951 17 0
‡ On 16,501 tons of slack, if taken at 4½d. per ton, (see Table I.) is ... 309 7 0

Total royalty per acre on the coals...£5261 4 0

TABLE III.

MISCELLANEOUS PARTICULARS.

Depth of pits in several situations in the North Staffordshire coal basin,—sunk in the crop of the mines :—

	Yards.
At Apedale, to the 7 and 8 foot coal	35
Ditto ..... ditto ditto	40
Podmore Hall ..... ditto ditto	90
Harecastle ..... ditto ditto	50
Ditto.....to rough 7 foot	70
Ditto.....to Little Roe..	113

At Lane-end or Moss-field Colliery, to the 4 foot 3 inch coal :—

In the *engine pit*	138
In the *bye pit*	130

At the Apedale Colliery, the distance from the surface to the bottom of the grey coal, is 715 yards 2 feet.

Diameters of cylinders of the steam engines for pumping the water from the mines, and of the whimsey engines, for drawing up the coals, at the above collieries :—

	Cylinder. Inches.	Pipe. Inches.
At Apedale, water engine	40	10
Ditto,.....whimsey.....	24	
Podmore Hall, water engine	36	10
Ditto,.....whimsey.....	16	
Harecastle or Woodshuts, water engine...	40	13
Ditto, ...whimsey	24	
Moss-field, water engine	52	12
Ditto, ...whimsey	18	

Cost, per ton, of melting iron at the specified rate of wages :—

Royalty, &c.	£4 0 7

TABLE IV.

Dimensions of the GATE ROADS, as driven in the various coal measures:—

Name of Measures.	Width. Ft.	In.	Height. Ft.	In.
Peacock coal	6	0	5	0
Spincroft	6	0	5	0
Great Roe	6	0	6	0
Kennel	6	0	6	0
Little Roe	6	0	6	0
Rusty Mine	6	0	6	0
Chalky Mine Rider	4	0	3	0
Single 4 foot	6	0	5	0
Five foot	6	0	5	0
Ragman	5	6	4	6
One yard to 7 foot	6	0	6	0
Hams	6	0	5	0
Ten foot	6	0	6	0
Top two Roe	4	0	2	0
Bowling Alley	6	0	5	0
Seven foot Nabbs	6	0	5	6
Eight foot Nabbs	6	0	4	6
Gray Coal	6	0	6	0
Bull Hurst	6	0	5	0
Wind Penny	4	0	3	0
Silver Mine	4	0	3	0
Under Mine	4	0	3	0

For the cost of driving these *gate roads*, and also the dimensions and cost of the *air heads*, see page 100.

MODE OF WORKING THE IRONSTONE MEASURES.

We have now to describe the mode of working, and to state the produce of the IRONSTONE MEASURES of the North Staffordshire Basin. In so doing, we still take the mines of the Apedale estate as our precedent, and refer to the diagram, figure 13, which is taken from the workings on that estate.

A and B are the shafts, of any sufficient diameter, with an engine placed between them, at C.

D D, the level or main gate road, from whence roads are driven out from E, E, E, E, at right angles, towards the extremity of the space to be cleared. They are supported with timber, if necessary, and along them the stone is conveyed to the pits.

F, F, F, stalls or openings of about 100 yards in width, and of the length of the working. In these stalls the clearing is commenced at the most distant part, and continued "homeward" towards the shafts.

G G, The outside stalls, or ends of the work, 50 yards wide.

H, H, H, H, are doors in the gate roads to prevent the current of air, which descends the pit, B,—from flowing, at once, back to the shafts,—and to drive it through the head, D I, along the workings or stalls, and then through the head, K D, to the pit, A, by which it

re-ascends. This course of atmospheric air is also assisted by the door, L, in the main gate road, which, after its descent down the shaft, B, stops its progress towards the opposite pit, and forces it forward through the head, I, into the general area of the mine.

It must be observed that the refuse of an ironstone measure, after getting out the balls or cakes, is still larger in bulk than the space which it had originally occupied. The stalls, therefore, as the work proceeds, are entirely filled with closely packed *gob*, still leaving considerable quantities to be drawn out of the pits;—the gate roads being carefully kept open, and supported, where necessary, by timber.

There are SIX principal *measures* of IRONSTONE in these mines, which are usually worked. Their thickness and produce are as follow:—

1. The CANNEL MINE, 5 feet 6 inches total thickness, contains six beds of ironstone, making in the whole 12 inches thick; and producing 18 cwt. to the square yard of surface measure. There is a "pricken holeing" in this measure. That is, the earth in which the holeing is performed, is soft and easily worked, so that a man will hole one-third more in length than in a rocky or indurated measure.

2. The BLACKSTONE measure, 5 feet thick, produces 8 cwt. of ironstone balls to the surface square yard.

3. The SHEATH stone lies above a parting in the Blackstone measure. It is 2 feet 3 inches thick, and contains two beds of stone, which together measure 9 inches in thickness, and produce 9 cwt. to the surface square yard.

4. The CHALKY MINE ironstone is 8 yards thick, and contains 11 beds of stone. It is reckoned to produce 2 tons of ironstone to the surface square yard.

5. The LITTLE MINE ironstone is 4 feet 6 inches thick, and contains 4 beds, measuring together 7 inches, and producing 10 cwt. to a square surface yard.

6. The BROWN MINE ironstone is 6 yards high, and produces 12 cwt. to the surface square yard.

The two following Tables refer to the getting and working of the IRONSTONE MEASURES of North Staffordshire.

TABLE I.

Produce and cost of the ironstone, various measures :—

Names of Measures.	Quantity per sq. Yard. T.	C.	Getting per Ton. s.	d.	Dead-work. s.	d.	Royalty. s.	d.	Total cost per Ton. s.	d.
Cannel mine ...	0	18	3	6	2	6	1	0	7	0
Blackstone	0	8	3	6	2	6	1	0	7	0
Rusty mine	0	9	4	6	2	6	1	0	8	0
Chalky mine ...	2	0	4	6	2	6	1	0	8	0
Little mine	0	10	4	6	2	6	1	0	8	0
Brown mine.....	0	12	3	9	2	6	1	0	7	3
Total produce per square yard	4	17					Measures...		6) 45	3
							Average cost per ton*...		7	6½

---

* The miners, by custom, reckon 24 cwt. to the ton of *ironstone*, so that if the produce be taken at 20 cwt. per ton, it will reduce the total cost one-sixth, making the actual cost only 6s. 3d. per ton, delivered at the banks or at the iron works, which is much lower than the cost of the same mineral in Shropshire, or in the south of Staffordshire.

TABLE I. continued.

The total quantity of ironstone produced from all the strata, according to the estimated quantities of each, which are given as above, from the best authority, being 4 ton 17 cwt. per yard, makes per acre, 23,474 tons, which, at a royalty of 1s. per ton, realizes the sum of

	£	s.	d.
	£1173	14	0
The royalty, per acre, of the coal strata, (see Table II. page 105)	5261	4	0
Total royalty, per acre, on COAL and IRONSTONE	£6434	18	0

TABLE II.

The cost, per ton, of the coal and slack which are used at the Apedale iron works, may be thus estimated, delivered at the banks, or at the works:—

COAL.

	£	s.	d.
Getting, per ton of 24 cwt.	£0	1	8
Drawing	0	0	8
Banking	0	0	2
Dead-work	0	2	6
Royalty, 1s. 3d. to	0	1	6
Total, per ton...	£0	6	6

Or if reduced to the ton of 20 cwt. the cost is 5s. 5d. or something less, according to the rate of royalty:—

SLACK.

	£	s.	d.
Getting, per ton of 24 cwt.	£0	1	3
Dead-work	0	2	6
Royalty	0	0	3
Total, per ton...	£0	4	0

Or at 20 cwt. to the ton.....3s. 4d. per ton.

N.B. The ROYALTIES paid are as follow:—
On Hams coal, per ton of 24 cwt...1s. 6d....Slack,...3d.
On Ragman, ditto ditto ...1s. 0d....Slack,...3d.

It would require about ten years to clear an acre of all the coals and *ironstone*, at the rate of 300 tons per week.

Having been thus minute in the account of the Apedale mine, further reference to the other mines of this district is unnecessary, as the stratification throughout, where complete excavations have been made, is nearly similar, and the products consequently the same.

THE

EAST SHROPSHIRE MINING DISTRICT.

THE East Shropshire mines of coal and ironstone, are found in a district, of which the boundary line may be drawn from the most northerly point, near Newport, through Prior's Leigh, Madeley, and Broseley, nearly as far to the south-west as Much-Wenlock;—then returning northward to the neighbourhood of the Wrekin Hill, and through Wellington and Hadley, towards Newport, the point at which we commenced. Its length may be thirteen miles, and its greatest width about five miles; the area being about fifty square miles.

The great Shrewsbury and Holyhead road, after crossing the South Staffordshire coal-field, traverses this district, from Prior's Leigh to Wellington, and presents to the traveller many scenes of great interest, all illustrative of the mineral productions of the earth, the occupations of the inhabitants, and the means which human ingenuity and enterprise, in obedience to increasing demand, have devised to facilitate the attainment and manipulation of the valuable mineral stores, and to effect their dispersion, when rendered available for use. The face of the country, without possessing features of actual beauty or grandeur,

becomes striking, as the road, surmounting the ascent from Prior's Leigh, commands the extensive scene of active industrial pursuits; the eye ranging over a wide panorama, from the Ketley Works on the left, to Hadley and Lillieshall on the right. The variations of the surface are considerable, and are parcelled out into forms of somewhat dreary wildness, unrelieved by the richness of vegetation. The mining and manufacturing buildings and machinery are seen at several points, and the smoke and blackness of furnaces, forges, and foundries, give a tone to every part of the prospect. The hurrying carriages are seen to flit along the railways and inclined planes,—conveying their burdens from the mines and works to the canals which intersect the country, and which provide a cheap mode of communication with the great seats of commercial enterprise throughout the empire.

The coal and ironstone strata, in this district, as in South Staffordshire, repose on a thick bed of transition or mountain limestone, which, for the most part, is of the kind denominated *black limestone*. The rise of this stratum is to the west north-west, usually at a gentle angle, and as we have elsewhere observed, it seems at all events possible, and a rational conclusion from analogies of other situations, that the limestone which appears in this country, is in fact a continuation, and re-ascension of the beds which dip down from the hills at Sedgley, and which, with all their super-imposed mineral strata, are lost, for many miles under the prevalent and deep beds of red sand stone.

The principal points where the limestone appears, are

on the banks of the Severn, near Coalbrook Dale;—on Wenlock Edge, a line of considerable elevation, where marine fossil remains are extremely abundant,—and again on the side of the Wrekin Hill. At all these places, the similarity of the limestone to that of Sedgley is apparent. At Wellington, again, it approaches the surface, but there bears more affinity in colour and in its fossil accompaniments, to the *white lime* of Dudley. At Lillieshall, and near Newport, it is obtained at a moderate depth, and is known as the *red lime*, but its texture and the large size of the shells which are frequently found embedded in it, declare its affinity with the lime stone of Sedgley. The stone of Wellington and Lillieshall is preferred as *flux* for the smelting furnaces.

Faults and dykes of various magnitudes occur in this basin, as in that of South Staffordshire; a very remarkable instance may be noticed, as extending from south-east to north-west, near Wombridge and Dunnington; on the north side of this fault the *clod coal*, which, in the Wombridge mines, lies 177 yards below the surface, is found at the depth of only 25 yards. The place of the same coal at Prior's Leigh, is not less than 300 yards deep.

The strata deposited in this basin are, generally speaking, of a nature similar to those of Staffordshire, and the trap, basalt, or green rock, is occasionally interposed between the strata, or accumulated in dykes, as in the other districts, but there appears no similarity or connexion in the order of deposition; nor is there any coal formation which bears any comparison with the *thick* or *ten yard coal* of Staffordshire. The beds of coal, are,

however, numerous, and several of them of excellent quality, but none exceeding five feet in thickness, except the "double coal," which is about two yards thick, and of which the name declares the comparative importance, among the other strata of the district.

Several of the coal measures are remarkably free from the sulphur, which, where it abounds, is so detrimental to the quality of the coal, and so prejudicial in the work of smelting at the iron furnaces. The ironstone, too, is of superior quality, and the pigs, bars, and rods of this country are fully equal to those produced from the Staffordshire iron works.

Vast quantities of coal, of iron in its various saleable forms, and of heavy *castings*, are conveyed by the canals to the river Severn. From Stourport, on this river, they find their way in some degree into Staffordshire and to Birmingham, but the principal portions descend the river, and are dispersed from Worcester, Glocester, and Bristol, to more distant markets.

MODE OF WORKING THE COAL AND IRONSTONE MEASURES.

We now proceed to describe the operations of getting the various beds of ironstone and coal, which prevail in the stratification of this basin. It will be observed on reference to the SECTION *of the Wombridge mine*, that the strata are all of moderate thickness, so as to be got out by the processes technically termed "holeing, brushing, and cogging;"—that is, by bringing down in lines of considerable length, the entire body of the coal, clearing it away, and supporting the roof by *cogs* or *pillars* of the *gob* or refuse slack and earth. This mode of getting has been already described in reference to the Staffordshire mines, under the name of LONG WORK; and to that description we refer the reader. (See page 29).

We have been favoured by a practical surveyor employed on the Wombridge mine, with the data relative to its produce, to the extent of work performed per day, and to the wages paid; on this information our calculations of prices have been formed.

The first measure worked, is the PENNY IRONSTONE. The total thickness of the stratum is two yards; but of this, 3 feet 6 inches, or little more than half is thought worth working; and this portion is by no means rich. The ironstone is found in the form of balls or nodules of

moderate size; and each yard square of the stratum surface measure produces about 3 cwt. of ironstone. A line of 30 yards long and 1 yard wide, produces generally 4 ton 8 cwt.

It requires, to clear this line in one day:—

Three holers, at 2s. 9d. per day	£0	8	3
Two brushers and coggers, 3s. 3d.	0	6	6
Drawing out	0	12	4
Total...	£1	7	1

Which gives 6s. 3d. per ton as the cost of the ironstone raised. The "drawing out" being the expense of conveying the mineral, from the place of the work, to its bank, within 100 yards of the pit's mouth.

The FUNGUS COAL, which is the next stratum worked, is 1 yard in thickness. It is usually holed under 1 foot 5 inches, measured horizontally, or at the base; and making about 1 foot 8 inches as the length of the inclined line drawn from the extremity of the holeing to the firm edge of the coal, or as it is provincially termed, —"the *curf*."

The *cuttings*, or perpendicular channellings, to facilitate the bringing down of the coals, are made at 4 or 5 yards distance from each other; and the quantity of marketable coal procured from each cubic yard, is computed to be:—

10 cwt. of large coal, or rather more.
2 cwt. of lumps.
3 cwt. of slack.

Total...15 cwt. to be raised, or thereabouts.

To bring down and clear away the usual line of 30 yards, in one day, requires:—

Three holers, at 2s. 9d. per day	£0	8	3
Three brushers and coggers, 3s. 3d.	0	9	9
Drawing out	1	5	0
Total...	£2	3	0

The produce will be:—

Coals,...17 ton 0 cwt. at 2s. 0½d.	£1	14	8
Lumps, 3 ton 8 cwt. at 1s. 2d.	0	4	0
Slack, ...5 ton 2 cwt. at 1s. 0d.	0	5	0
Total...	£2	3	8

The BLACK IRONSTONE measure is 4 feet thick, and produces 8 cwt. of ironstone measured at the surface. Each man holes, per day, 12 yards long and 2 feet 6 inches under. Two men will brush and cog 30 yards in length, per day, which length produces about 10 tons of ironstone.

The labour required to clear and raise the 30 yards long and 2 feet 6 inches wide, is, therefore:—

2½ men, at 2s. 9d. per day	£0	6	10½
Two men to brush and cog, 3s. 3d.	0	6	6
Loading and drawing out	0	12	4
Total...	£1	5	8½

Or 2s. 6¼d. per ton of ironstone.

The STONE COAL is 4 feet thick;—it is holed under as described in reference to the *fungus coal*, 1 yard 5 inches on the level of the stratum; the line from the *curf*, or solid edge of the coal, to the extremity of the *holeing*, being 1 foot 9 inches. One man will hole 10 yards per day; and four men will brush and cog 30 yards in a day.

It therefore requires, to work out and carry away 30 yards in length, per day:—

Three holers, at 2s. 9d. per day	£0	8	3
Four brushers and coggers, at 3s. 3d. ...	0	13	0
Loading and drawing out	1	14	0
Total...	£2	15	3

The produce of this length will be:—

	T.	C.	Q.				
Coals,...	22	13	1	at 1s. 11d.....	£2	3	1
Lumps,	4	10	0	at 1s. 2d.	0	5	3
Slack, ...	6	15	0	at 1s. 0d.	0	6	9
Total...					£2	15	1

The BRICK IRONSTONE measure is 5 yards 1 foot thick, of which only 2 foot 6 inches are got out, a square yard of which produces 6 cwt. of ironstone.

One man holes, per day, 10 yards in length and 2 feet 6 inches under. Two men will brush and cog the 30 yards in one day. The cost of labour, to get out this quantity, will therefore be:—

Three holers, at 2s. 9d. per day	£0	8	3
Two brushers and coggers, 3s. 3d.....	0	6	6
Loading and drawing out	0	12	4
Total...	£1	7	1

The quantity of ironstone produced is about 7 ton 10 cwt. and the cost per ton, is 3s. 7d.

The BALL IRONSTONE measure is 3 yards thick, of which only 1 yard is worked. The mode of getting, and the average amount of the labour, are the same as in the last measure.

The cost of clearing 30 yards in length, is therefore, as in the brick ironstone, £1 7s.

The ironstone produced is a little more than 5 cwt. to the square yard, or 6 ton 5 cwt. from the 30 yards. The cost, per ton, is therefore, 4s. 4d.

To these beds of ironstone, succeed several coal measures, which are all worked. These are :—

The TOP COAL, which is 5 feet thick, and is of fair quality, both for the use of the furnace, and for domestic purposes. It produces from the cubic yard, about 12 cwt. of coal, and 3 cwt. of slack.

It is holed under in the customary manner, namely, 1 foot 9 inches from the *curf* to the extreme point of the excavation. One man will hole under 15 yards in length; and two more will brush and cog the same quantity.

The cost, in labour, to get the length of 30 yards, is therefore :—

Two holers, at 2s. 9d. per day	£0	5	6
Four brushers and coggers, 3s. 3d.	0	13	0
Loading and drawing out	2	2	0
Total...	£3	0	6

The produce is:—

Coals,...34 ton 0 cwt. at 1s. 7d.	£2	13	10
Slack,... 8 ton 11 cwt. at 1s. 0d.	0	8	6
Total...	£3	2	4

The DOUBLE COAL is the next measure. This is 2 yards in thickness, and is of good quality. It is brought down in the usual manner, by holeings, 1 foot 5 inches horizontal measure, with cuttings at every 4 or 5 yards. One man will hole under 10 yards per day; and to brush and cog 30 yards in one day, will require five men.

The labour required to clear the 30 yards, will be:—

Three holers, at 2s. 9d. per day	£0	8	3
One cutter	0	2	9
Five brushers and coggers, 3s. 3d.	0	16	3
Loading and drawing out	2	11	0
Total...	£3	18	3

The produce will be:—

Coals,...34 ton 0 cwt. at 1s. 9d.	£2	19	6
Lumps, 6 ton 15 cwt. at 1s. 2d.	0	7	10½
Slack, 10 ton 0 cwt. at 1s. 0d.	0	10	0
Total...	£3	17	4½

The YARD COAL is one yard thick; and with this coal measure is got the YELLOW IRONSTONE, which adjoins it, and which produces about 5 cwt. to the square yard. Of these joint measures, one man will hole, per day, 10 yards in length, and the minerals usually come down without cutting. One man will brush and cog 15 yards per day. The labour required to clear 30 yards in length, in one day, will consequently be:—

Three holers, at 2s. 9d. per day	£0	8	3
Two brushers and coggers, 3s. 3d.....	0	6	6
Loading and drawing the coal	1	3	0
Ditto ditto the ironstone	0	15	0
Total...	£2	12	9

The produce is:—

Coals, ...15 ton 0 cwt. at 2s. 0d.	£1	10	0
Lumps, ...3 ton 0 cwt. at 1s. 2d.	0	3	6
Slack, ...4 ton 10 cwt. at 1s. 0d.	0	4	6
Ironstone, 7 ton 10 cwt. at 2s. 0d.	0	15	0
Total...	£2	13	0

The BLUE FLAT ironstone measure is 2 yards thick, 4 feet of which only are worked. The produce is about 6 cwt. to the square yard.

The labour required to clear 30 yards in length, in one day, holed under 2 feet 4 inches, or 23¼ square yards, is:—

3¼ holers, at 2s. 9d. per day	£0	9	7
Two brushers and coggers, 3s. 3d.....	0	6	6
Loading and drawing out	0	12	4
Total...	£1	8	5

The quantity of ironstone raised, being 6 ton 15 cwt. at 4s. 2d. per ton.

The WHITE FLAT ironstone is 2 yards thick; 2 feet 9 inches only of which are worked. One man will hole under in one day, nearly 8 yards in length, and 2 feet 3 inches under. The produce being about 4 cwt. to the square yard.

To clear 30 yards per day, or 22½ yards square, requires :—

Four holers, at 2s. 9d. per day	£0	11	0
Two brushers and coggers, 3s. 3d.....	0	6	6
Loading and drawing out	0	12	4
Total...	£1	9	10

The ironstone raised, being 4 ton 10 cwt. at 6s. 7d. per ton.

The FLINT COAL is 5 feet thick, and is holed in the usual manner; the work of one holer being 12 yards per day. It is brought down by *cuttings*, at distances of about 5 yards.

The labour required in getting 30 yards in length, in one day, is :—

2½ holers, at 2s. 9d. per day	£0	6	10½
Four brushers and coggers, 3s. 3d.	0	13	0
Two cutters, 2s. 9d.	0	5	6
Loading and drawing out	2	2	6
Total...	£3	7	10½

The produce is :—

Coals,...28 ton 7 cwt. at 1s. 10½d.	£2	13	1
Lumps, 5 ton 14 cwt. at 1s. 2d.	0	6	8
Slack, ...8 ton 10 cwt. at 1s. 0d.	0	8	6
Total...	£3	8	3

The next stratum is another PENNY IRONSTONE measure. It consists of a thin continuous stratum of ironstone, only 3 inches thick, which is found immediately under the flint coal, and which covers an extensive deposit of argillaceous earth, or *clunch*. Beneath the upper part of this stratum, and dispersed irregularly in the thick measure, are included round and flat balls or cakes of ironstone. The entire measure is 8 yards thick; it is worked in sections or grades of 4 feet each high, commencing with the upper one;—till the valuable contents of the whole are extracted. The produce of one square yard of surface, taken through one of the working portions of 4 feet, is considered to be between 4 and 4½ cwt. of ironstone, or 24 cwt. to the surface yard, through the whole six working sections. One man will hole, per day, nearly 8 yards in length, and 2 feet 3 inches under, so that the

expense of getting out 30 yards long of one of the stages or sections of 4 feet high, per day, is as follows:—

	£	s.	d.
Four holers, at 2s. 9d. per day	£0	11	0
Three brushers and coggers, 3s. 3d.....	0	9	9
Loading and drawing out	0	12	4
Total...	£1	13	1

The produce of the 30 yards of each section or stage being about 6 ton 10 cwt. the cost of the stone is 5s. per ton.

The RANDLE and CLOD COALS occur with a parting of clay or "clod," lying between them.

	Yds.	Ft.	In.
The *randle coal* is, in thickness	1	0	0
The *clod* coal.....	1	1	0
Total...	2	1	0

These measures are worked together, the miner holeing the usual width of 1 yard 9 inches "to the curf," under the lower seam, or *clod* coal. No cuttings are required, as the weight of the parting disposes the coal to break down, and provides material for the cogs or pillars.

One man will hole 10 yards per day, but the brushers and coggers only complete between 7 and 8 yards, in the same time. The expense of working the usual length of 30 yards per day, of the two measures, is:—

	£	s.	d.
Three holers, at 2s. 9d. per day.....	£0	8	3
Four brushers and coggers, 3s. 3d.	0	13	0
Loading and drawing out	3	0	0
Total...	£4	1	3

The produce of this length of the two kinds is:—

Coals,.....40 ton, at 1s. 9d.	£3	10	0
Lumps, ... 8 ton, at 1s. 2d.	0	9	4
Slack,.....12 ton, at 1s. 0d.	0	12	0
Total...	£4	11	4

The lowest known valuable stratum in this district, as in that of Staffordshire, is the LIMESTONE, of which mention has been made in our preliminary descriptive sketch. This extensive deposit, in this situation, has not been worked through. The total thickness therefore is unknown. It is probably not less than 10 yards, and when worked, is got out of large openings, leaving pillars at proper distances, to support the roof and the superincumbent strata. The workmen's price for delivering the limestone on the bank, is 1s. to 1s. 6d. per ton, according to the distances both in the mine and at the surface. The other expenses, as sinking, ropes, salary to clerks, wear and tear of machinery, &c. may be taken at 1s. per ton, so that the total cost of the limestone is about 2s. 6d. per ton, exclusive of the royalty, which is 6d. per ton.

We now proceed to recapitulate and arrange in a tabular form, the data afforded by our preceding statements.

TABLE I.

The thickness and cost of production, per ton, of the coal in each stratum :—

Names of Coal Measures.	Thickness. Yds.	Ft.	In.	Cost per Ton. Coals. s.	d.	Lumps. s.	d.	Slack. s.	d.
Fungus coal.....	1	0	0	2	0½	1	2	1	0
Stone	1	1	0	1	11	1	2	1	0
Top	1	2	0	1	7	1	2	1	0
Double.....	2	0	0	1	9	1	2	1	0
Yard.....	1	0	0	2	0	1	2	1	0
Flint.....	1	2	0	1	10½	1	2	1	0
Randle and clod ...	2	1	0	1	9	1	2	1	0
Total thickness...	11	0	0						
Strata...7)				12	11	8	2	7	0
Average cost.....				1	10	1	2	1	0
Dead-work or sundries...				2	0	2	0	2	0
Royalty.....				0	8	0	4	0	2
				4	6	3	6	3	2

TABLE II.

The thickness and cost per ton, of the ironstone in each stratum :—

Names of Measures.	Thickness. Yds.	Ft.	In.	Quantity per square Yard of Surface Measure. T.	C.	Q.	Cost of getting per Ton. £	s.	d.
Penny Ironstone ...2	0	0	0	4	0	0	0	6	3
Black ditto 1	1	0	0	8	0	0	0	2	7
Brick Measure ...5	1	0	0	6	0	0	0	3	7
Carried forward, 8	2	0	0	18	0	0	12	5	

TABLE II. continued.

	Yds.	Ft.	In.	T.	C.	Q.	£	s.	d.
Brought forward,	8	2	0	0	18	0	0	12	5
Ball Stone	3	0	0	0	5	0	0	4	4
Yellow Ironstone	3	0	0	0	5	0	0	2	0
Blue Flats	2	0	0	0	6	0	0	4	2
White Flats	2	0	0	0	4	0	0	6	7
Penny Ironstone	8	0	0	1	4	0	0	5	0
Totals	26	2	0	3	2	0			
						Measures...8)	1	14	6
Average cost of getting per ton							0	4	7½
Dead-work							0	2	6
Royalty							0	1	0
Total expense per ton							0	8	1½

TABLE III.

The produce per acre, and amount of royalty, of coals and ironstone :—

	Produce per Acre. Tons.	Rate of Royalty per Ton. s.	d.	Amount of Royalty per Acre. £	s.	d.
Coals	26,620	0	8	887	6	8
Lumps	5324	0	4	88	14	8
Slack	7986	0	2	66	11	0
Ironstone	13,794	1	0	689	14	0
Total...	52,724	Total royalty...		1732	6	4

TABLE IV.

The quantity of *coal* of each measure, got by each man, per day, according to the statements previously given:—

Names of Measures.	Coals.			Lumps.			Slack.		
	T.	C.	Q.	T.	C.	Q.	T.	C.	Q.
Fungus coal.....	2	16	2	0	11	1	0	17	0
Stone coal	3	4	2	0	12	3	0	19	1
Top coal	5	13	1	0	0	0	1	8	2
Double coal	3	15	2	0	15	0	1	2	2
Yard coal.....	3	0	0	0	12	0	0	18	0
Flint coal.....	3	6	2	0	13	1	1	0	0
Randle & clod coal	5	14	1	1	2	3	1	14	1
Strata ...7)	27	10	2	4	7	0	7	19	2
Average day's getting, nearly	3	18	2	0	12	2	1	2	3

TABLE V.

The quantity of *ironstone* got by each man, per day, and per week, five days being considered as a week's work:—

	Per Day.				Per Week of five Days.		
	T.	C.	Q.		T.	C.	Q.
Penny Stone	0	16	0	.....	4	0	0
Black Ironstone	2	4	0	.....	11	0	0
Brick ditto	1	10	0	.....	7	10	0
Ball Stone	1	5	0	.....	6	5	0
Blue Flats	1	4	0	.....	6	0	0
White Flats..... ...	0	15	0	.. ..	3	15	0
Penny Stone	0	18	3	.....	4	14	3
Strata...7)	8	12	3	.....	43	4	4
Average getting of each man, daily.....	1	4	3	weekly	6	3	2

TABLE VI.

Dimensions and cost of the *gate roads* or *waggon roads*, driven in the various measures of coal and ironstone, per yard in length.

In any cases where these roads are "taken in the *gob*," or in the piles of refuse and waste, left after clearing the valuable minerals,—no charge is paid by the proprietor.

GATE ROADS.

COALS.	Wide. Ft.	Wide. In.	High. Ft.	High. In.	Cost per yard. s.	Cost per yard. d.
Fungus coal	4	0	4	0	5	0
Stone coal	4	0	5	0	6	0
Top coal	6	0	7	0	6	0
Double coal	6	0	7	0	6	0
Yard coal	6	0	6½	to 7 ft.	6	0
Flint coal	6	0	5	0	6	0
Randle and clod coal	6	0	7	0	6	0

The gate roads in the ironstone measures are universally taken *in the gob*, and are consequently not chargeable. Their dimensions are as follow :—

IRONSTONE.	Wide. Ft.	Wide. In.	High. Ft.	High. In.
Top Penny Stone	4	0	5	6
Black Ironstone	5	0	5	6
Brick ditto	5	0	6	0
Ball Stone	5	0	6	0
Blue Flats	5	0	6	0
White Flats	5	0	6	0
Lower Penny Stone	5	0	0	0

The *air heads* are usually 3 feet 3 inches square, and their cost 3s. 4d. to 4s. per yard in length.

The value, per acre, of the entire strata of coal and ironstone, if two acres per annum are got out, may be taken at £890 present payment.

Cost, per ton, of manufactured iron, at the rate of wages and royalty specified:—

Forge and pig	£3	9	5
Bar	6	9	5

all made from COLD BLAST.

NOTE.—The use of the *hot air blast,* with raw or *uncoked* coal, in the smelting of iron, is not without its advocates, but makes slow advances in these central mineral districts. In Scotland it is extensively and successfully practised,—as the coal of that country contains less of sulphur in its composition.

It is not improbable that experience, with the aid of chemical science, may render the hot air blast more extensively applicable. The result will be a considerable economy both of labour and of fuel, which of course will cause the production of manufactured iron at a proportionably lower rate than at present.

*** The aforesaid results are taken from calculations made by a ground bailiff of this district, as to the number of yards holed, brushed, and cogged, per day, by the miner in each strata.

THE

WARWICKSHIRE COAL-FIELD.

DESCRIPTION.

THE known coal-field or basin of Warwickshire, extends in a line bearing from south-east to north-west;—from the Hamlet of Wyken, in the immediate neighbourhood of Coventry, to the village of Polesworth, in the northern angle of the county; the length being about 16 miles, and the breadth varying from 3 to 5 miles. The general rise of the strata is in a direction east north-east, and the square contents may be estimated at about 60 square miles.

The principal seat of the mining operations is in the neighbourhood of Bedworth, where the depth of the pits, as shown in the Chart,—Section headed "WHEELDON," is about 180 yards. Mines are at work in other situations, but not with equal profit, as the strata vary considerably in thickness and value.

The coals produced in this quarter, are sent by canals to Coventry, to many parts of Oxfordshire and Northamptonshire; and likewise to London; the distance to which city, by canal, is 130 miles.

The quality of the coal, generally, is not equal to that of Staffordshire and Shropshire. It is good for domestic purposes, but would not produce *coke* of sufficient

strength to be used in iron furnaces; it is also not eligible for blacksmiths' fires.

There are no ironstone measures in this district, of quantity and quality sufficient to authorize the working of them. Stow, in his notes on Leland's Itinerary, speaking of the homely manufactures of Birmingham, says, "They get yren out of Staffordshire and Warwikeshire, and see coale out of Staffordshire." This statement however is probably erroneous in that part which relates to Warwickshire;—as the ironstone measures of Staffordshire must have been always more accessible and more valuable than those of Warwickshire, which are by no other authority recorded to have been ever worked. In a word, the district in question, as to its mineral treasures, is a *coal country* exclusively.

The *getable* coals of the Warwickshire basin, or those measures which are sufficiently productive to yield a profit to the mining speculator, are found in one series of contiguous strata, approaching a total thickness of 8 yards, including the *partings* of stony matter.

The position and inclination of the different layers are exhibited in figure 15, and the following Table expresses the order and thickness, and the vernacular denomination of the several beds :—

	Thickness. Yds.	Ft.	In.
Two yard coal	1	2	6
Parting	0	0	8
Rider coal	1	1	0
Ell coal	1	2	6
Parting	0	0	9
Coal roof	0	1	6
Slate coal	1	2	0
Total thickness...	7	1	11

Total thickness brought forward...				7	1	11
Deduct, as above,	Yds.	Ft.	In.			
The two partings.....	0	1	5			
Coal roof left for support.....	0	1	6	0	2	11
Total thickness of coal generally raised...				6	2	0

MODE OF WORKING.

THE author is familiarly acquainted with the coal strata, and with the mode of working them, at the Hawkesbury Colliery, near Bedworth, having been employed in the year 1829, as agent for George Wheeldon, Esq. the proprietor. The following description, therefore, may be considered as applying to the collieries in that vicinity.

The inclination or dip of the strata in this situation, is considerable, being, in many cases, 8 inches per yard, so that mechanical means are required to draw the loaded skips up to the shafts, as the gate roads are always driven towards the deep of the mine. The mode of effecting the purpose, therefore, is to extend a chain from the drum barrel of the whimsey engine, over a pulley at the top of the shaft, thence to the bottom of the pit, and round another pulley. From this point, the chain proceeds to the extremity of the inclined gate road, where the work is carried on, and where it is attached to the waggon carrying the loaded skip, by means of a ring and hook. The machinery being put in motion, the

waggon and its burden are drawn up the slope to the foot of the shaft, from whence they are raised to the surface in the usual way, and an empty waggon being attached to the chain descends to the proper place to be loaded.

The following is the mode of working generally adopted in these mines. From a pit or shaft, as A, figure 14, a *gate road*, A B, is driven, as already described, in the direction of the deepening strata, to a distance of about 300 yards, at the end of which the coal is *headed* out at right angles on either side, to C and D, about 50 or 60 yards, as circumstances dictate;—the entire heading of the work thus taking the form of a Roman T.

These preparations being made, the coal from each *side of work*, C B, and B D, is begun to be got out, at the farther extremity, and is drawn up hill by means of the apparatus of pulleys and chains, to the shaft, till the whole is cleared out.

Other shafts in the immediate neighbourhood, as E E, to any number, are sunk, communicating with their respective gate roads and sides of work, so that an entire colliery presents a range or series of works, each having its gate roads constructed on the plan described, and the contiguous clearings, F, F, F, proceeding, till ribs of coal, 10 or 12 yards thick, alone intervene between them.

These ribs of coal are left untouched, both to support the earth above, and to prevent extensive damage, by cutting off the communication, should the slack in any of the workings take fire. They are excavated through part of their extent by narrow passages or heads, G, G, in order to promote the necessary circulation of air.

Plate.6.

Fig.14.

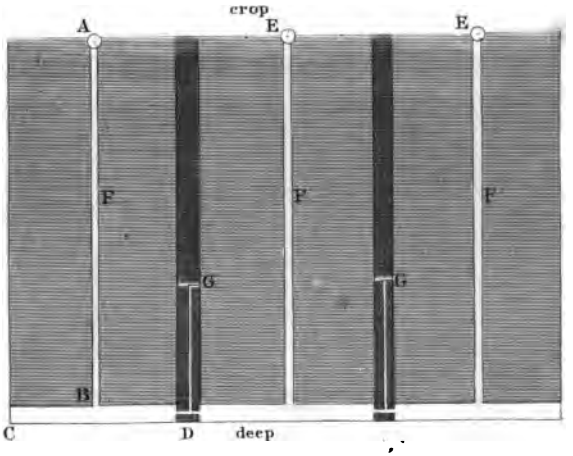
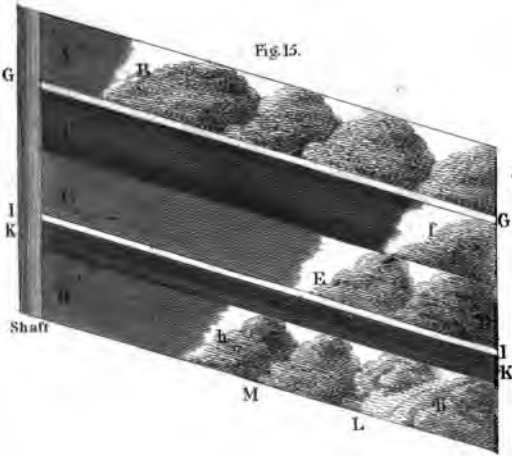


Fig.15.



	y.	f.	in.
	1	2	6
G	.	.	8
	1	1	0
	1	2	6
I	.	.	9
K	.	1	6
	1	2	0
	7.	1.	11

These, however, may be closed up in case of firing, and the draught or current thus stopped.

There is the more hazard of the accidental firings from the circumstance of no *slack* being raised from the pits. This arises from the absence of iron works, or any manufacture which should produce a market for the slack, so that no coal, in masses smaller than what are called *lumps* or *cobbles*, is drawn out, and large quantities of the finer slack are thrown back and used to form the pillars which support the earth, where work is going on. The proportions of the different descriptions of coal got out, may be stated as eight-ninths *large coal*, and one-ninth *lumps* or *cobbles*, without any slack except that which arises from casual breakages in loading and drawing, and that which is consumed by the whimsey and water engines;—the several *butties* or *charter masters*, who take the work by contract or charter, agreeing to find, each one, the proportion of slack requisite for the supply of the engines, as respects the work undertaken by him.

The coal lying in several contiguous measures, as has been described, it is got by means of *gate roads*, driven one under the other, through its successive stages. Of these roads, the first is driven along the bottom of the upper stratum, called the TWO YARD COAL;—see figure 15, A. This coal is got by holeing under in convenient sections, supporting the rocky roof by cogs or pillars of slack and refuse, as at B, where the coal is supposed to have been got out.

This upper coal being cleared, the second heading in the order of descent, is then driven through the ELL

COAL, C. A certain portion of this coal, perhaps a distance of about 8 yards being got out, as from D to E, a new surface is opened at f, in the RIDER COAL, F, which lies above it. These measures are thus got out through the whole working, the *rider* following the clearing of the *ell coal*; one gate road sufficing to take out the coal from both measures. The deep space being cogged or *gobbed* up by the vast quantities of refuse and slack which are left behind, and the parting of 8 inches thick, G G, alone intervening, between the cavity formed by getting out the *ell* and *rider coals*, and that previously produced by clearing away the *two yard coal*.

The third and lowest heading is then driven through the SLATE COAL, H, which is got out in the usual manner, being headed as the other measures, and the cleared space cogged up, as at h h. Below the *ell coal*, as will be recollected, occurs a parting of 9 inches thick, I I, but this is considered insufficient for the support of the roof, and a uniform layer of *coal*, 18 inches thick, k k, is left to strengthen the support, under the name of the COAL ROOF.

Thus, to get out the whole clear height, or 6 yards 2 feet of coal, three gate roads are driven, and four faces of work opened, which necessarily causes much waste, besides the entire loss of the *coal roof* of half a yard thick, and the wide ribs which occur at distances of 100 yards asunder. These losses might probably be prevented, or much reduced, by pursuing judiciously the mode of "long work," recommended in reference to the *thick coal* of South Staffordshire. On this plan, a single gate road would be driven to the proposed extent of the

work, on the *lowest level*, as at H, figure 15, (being the bottom of the SLATE COAL), and the getting would commence by bringing away the entire *slate coal*, and with it, that which is now left as *coal roof*, for the space of 8 or 10 yards, to L. This being done, a face would be opened in the ELL COAL, at D, which would be got through a similar space, and carried away through the same gate road, the working of the slate coal at the same time proceeding towards M. The RIDER COAL, F, and TWO YARD COAL, A, would then be opened in successive faces, and all got to the proposed distance by means of the same gate road. The work would thus proceed on the plan described in reference to the *ten yard coal;* each lower range working onwards 8 or 10 yards *a-head*, or in advance of the one above it, (see figure 6), and thus the entire coal would be cleared up to the shafts without leaving ribs or roof of untouched coal in the mine. A similar course of proceeding might then be commenced on the other side, or above the shafts; where, in a new *side of work*, a similar clearing would be effected. On this plan of working, the holeing, after the lowest coal is got, being done by the workmen, *in the gob*, would also be much cheaper than when cut out of the solid coal, so that a double economy would be the result. It may be imagined that the extensive accumulation of slack or gob, as pillars, might occasion the spontaneous firings, which, at present, are in some degree prevented by the ribs;—but this hazard might be guarded against, if proper attention were paid, by constantly mixing a portion of *sand* with the slack, as the cogging proceeded.

PRICES OF WORK, AND OTHER PARTICULARS.

THE prices usually given as wages to the working miners, in these collieries, are 3s. per day, with one quart of ale, valued at 3d.—candles, 2d.—and sharpening of pikes, 1d.—all tools being also found by the employer.

On this scale of wages, the expenses of the various parts of the work at the mines alluded to, namely the Hawkesbury Colliery, near Bedworth, may be stated nearly as follows :—

1. The *sinking of the pits.* These are always 8 feet in diameter, and defended throughout the whole depth of 180 yards, by brick and mortar. The price paid to the sinker, is £2 per yard in depth ;—powder and tools being found by the proprietor ;—the total expense, including materials, being from £3 3s. to £4 per yard.

2. The heading out of the *gate roads,* proceeding from the shafts, (see the figures 14, 15). The dimensions of these roads are usually 5 feet wide by 4 feet 6 inches high, and their cost 6s. 6d. per yard in length, besides the charter on the coal, which is 3s. per ton, and on the slack, 1s. 6d. per ton. The *air heads* are 3 feet 3 inches square, and cost, driving, from 3s. to 4s. per yard.

3. The *openings* at the ends of the gate roads, in order to get the coals, as C D, figure 14. These openings are made the whole length of the faces of work, and the cost of them is 10s. per yard in length. The charter on the large coals being 3s. and on the slack, 1s. 6d. as before stated.

4. The *getting* of the various measures of the coal. This, with the cost in dead work, and royalty,—and the profit *per ton*, may be more conveniently stated in a tabular form, as follows:—

Names of Measures.	Getting per Ton.		Dead-work.		Royalty.		Profit.		Total or cost Price.		
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	£	*s.*	*d.*
Two yard coal	3	0	3	0	1	0	4	6	0	11	6
Rider coal ...	3	0	3	0	1	0	3	7	0	10	7
Ell coal	3	0	3	0	1	0	3	8	0	10	8
Slate coal.....	3	0	3	0	1	0	3	7	0	10	7
				Measures...4)			15	4	2.	3	4
Average profit and average price per ton, for the best coals ...							3	10	0	10	10

With respect to the quality of the coals of this district, it is to be observed, that they are easily affected by the action of the atmosphere. When stocked for winter's sale, their surfaces decay, or, as it is termed, "slack away," so that, on their removal, a large quantity is left behind in the form of broken and softened coal, which is obliged to be sold at a reduced price, thus occasioning a great loss, which must always be taken into account by the *butty* or *charter master*. The best part of the coal is used for domestic purposes; the deteriorated portion is adapted to the burning of lime and bricks.

The average price of best coal, as above stated, being 10s. 10d. per ton, the price of the soft or "slacked" coal is generally 8s. which reduces the real average price to about 9s. 3d. per ton; and as the getting, work, and royalty, in all cases, amount to 7s. per ton, the net profit is thus reduced to 2s. 3d. per ton.

The price of lumps or cobbles, at the time alluded to, (1829), was, per ton.....£0 5 0

Of which the cost of getting and drawing out, being taken at..... 0 2 6

Leaves profit, per ton...£0 2 6

The total produce, royalty, and profit, per acre, of the entire coal stratification, may be thus stated :—

	Produce per Acre.	Royalty. p. Ton.	Royalty. Per Acre.			Profit. p. Ton.		Profit. Per Acre.		
	Tons.	*s.*	*d.*	£	*s.*	*d.*	*s.*	*d.*	£	*s.*	*d.*
Coals	14,521	1	0	726	1	0	2	3	1633	12	0
Lumps or cobbles	1086	0	6	27	3	0	2	6	135	15	0
				753	4	0			1769	7	0

The quantity left in the earth in the form of *ribs*, is about 1612 tons per acre.

On these data the coal land may be valued at £386 per acre, present payment.

Upon the usual mode of working, each man will get, per day, 2 ton 3 cwt. of coal; each ton costing, in loading, drawing out, banking, and loading into the waggon, from 1s. 3d. to 1s. 6d. timber, powder, and sundries included.

If the coal were got on the proposed improved plan, as detailed above, working by one gate road, from top to bottom, in LONG WORK, each man would get 2 ton 10 cwt. per day.

THE

LANCASHIRE COAL-FIELD.

THE following statements of the cost of the coal and slack, as raised from the Lancashire mines, it is presumed will be acceptable. They are derived from a gentleman actively engaged in the mining pursuits of that important district.

PEEL COLLIERY,—SEVEN FOOT COAL.

Rider coal ...4s. 0d. for 3 tons, or 1s. 4d. per ton.
Round coal...4s. 0d. for 3 tons, or 1s. 4d. per ton.
Small coal ...2s. 1d. for 3 tons, or 0s. 10d. per ton.

HEADINGS.

The waggon roads, cost per yard in length...2s. 6d.
Common ends .....1s. 9d.
Narrow boys.....1s. 6d.

LITTLE LEVEL SIX FOOT COAL.

Round coal, 4s. 3d. for 3 tons 5 cwt. or 1s. 3d. per ton.
Small coal 2s. 11d. for 3 tons 5 cwt. or 0s. 10d. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 0d.
Ends.....1s. 9d.
Narrow boys.....1s. 2d.

BRIGHT NINE FOOT COAL.

Riddled coal...4s. 0d. for 3 tons, or 1s. 4d. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 0d.
Ends .....1s. 6d.
Narrow boys..... .....1s. 3d.

TONNAGE MORE,—NINE FOOT MINE.

Round coal 4s. 0d. for 3 tons, or 1s. 4d. per ton.
Small coal...2s. 10d. for 3 tons, or 0s. 10d. per ton.

CRUMBOUCH COAL, AT PEEL COLLIERY.

Rider coal.....4s. 9d. for 3 tons, or 1s. 7d. per ton.
Slack .....2s. 0d. for 3 tons, or 0s. 8d. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 6d.
Common ends ....2s. 0d.
Narrow boys.....2s. 0d.
Extra for holeing in dirt .....0s. 4d.

BRASSY MINE,– CLIFTON.

Rider coal.....4s. 9d. for 3 tons, or 1s. 7d. per ton.

HEADINGS.

Waggon roads, per yard .....1s. 9d.
Ends.....1s. 9d.
Narrow boys.....1s. 6d.

CRUMBOUCH.

Round coal ...4s. 8d. for 3 tons, or 1s. 6d. per ton.
Small coal.....3s. 4d. for 3 tons, or 1s. 0d. per ton.
Headings, similar to the last.

PENDLEBURY FOUR FOOT COAL.

Round coal ...4s. 9d. for 3 tons, or 1s. 6d. per ton.
Small coal.....3s. 2d. for 3 tons, or 1s. 0d. per ton.
Headings, similar to Brassy Mine.

QUARTER COLLIERY.

Round coal, 4s. 9d. for 2 tons 8 cwt. or 1s. 11d. per ton.
Small coal...3s. 9d. for 2 tons 8 cwt. or 1s. 6d. per ton.
Bricky round coal ...4s. 6d. for 2 tons 8 cwt. or 1s. 10d. per ton.
Small coal...3s. 6d. for 2 tons 8 cwt. or 2s. 1d. per ton.

TURTON BOTTOMS.

Round coal, 5s. 0d. for 2 tons 8 cwt. or 2s. 1d. per ton.
Small coal...5s. 0d. for 2 tons 8 cwt. or 2s. 1d. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 0d.

EALESTONE COLLIERY,

(RUSSELL AND PARKE.)

Riddled coal...5s. 0d. for 5 tons 16 cwt. or 10½d. per ton.

HEADINGS.

Waggon roads, per yard .....1s. 9d.
Ends.....1s. 6d.
Narrow boys.....1s. 6d.

WAGGONERY OR DRAWING, TO BE ADDED,

For the first 100 yards along the level .....1s. 0d.
For every 50 yards further, extra, per ton .....0s. 1d.

BURROW LANE.

Riddled coal, 4s. 6d. for 4 tons 15 cwt. or 1s. Cd. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 0d.
Ends.....1s. 6d.
Narrow boys.....1s. 6d.

SIR JONES.

Riddled coal, 6s. 0d. for 4 tons 10 cwt. or 1s. 4d. per ton.

HEADINGS.

Waggon roads, per yard .....2s. 0d.
Ends.....1s. 6d.

At these prices the coals are got and brought to the foot of the shaft, supposed to be 100 yards along the level.

*** The coal of Lancashire is found in two districts:—the first and by far the largest and most important, is that of the *south*. It takes an irregularly curved, or *crescent form*; the two points lying respectively south-east and south-west;—Manchester occupying nearly the central point in the curve. The distance between the two extremities is about 40 miles. The stratification approaches, in considerable degree, to that of North Staffordshire, towards which it makes near approach at its south-eastern angle. There are nearly 50 beds of coals found, of different thicknesses and qualities, before the operations of the mine close, by arriving at the limestone shale, or millstone grit. The dislocations are also very great, and the angle of the dip, generally, considerable.

The *North Lancashire* coal-field is of small extent. The town of Lancaster is situated near its southern boundary, but it has not, at present, been to any great extent explored.

[*See Conybeare and Phillips's Geology of England.*]

THE

NEWCASTLE AND DURHAM COAL-FIELD.

THE NORTH-EASTERN or NEWCASTLE coal-field, is, and has long been, of immense importance to the country; it is of great extent, reaching from the *Coquet* River to the *Tees*, a length of 55 miles; its breadth from the mouth of the Tees, westward, being almost 22 miles. The dip of the strata, generally, is from west to east. On the western side, the coal measures crop out and are lost, and the sub-stratum of coarse sand stone, called *millstone grit*, is exposed. On the eastern side, from the Tyne, southward, the coal is covered by a very thick bed of *magnesian limestone*, under which, beneath the German ocean, the course of stratification probably continues to an indefinite distance.

The number of coal seams is very great, but many are too thin to be worked. The most valuable are those called the HIGH MAIN and LOW MAIN.

The order of strata in the western portion of the field, where the magnesian limestone does not prevail, is, generally, as follows :—

	Yards.
From the surface, through clay, sand stone, and shell, with 8 inconsiderable layers of coal, varying from 8 to 18 inches in thickness	187
The HIGH MAIN coal, about	2
Sand stone and shale, with 19 seams of coal, from 2 inches to 1 yard in thickness	167
LOW MAIN COAL	3
Stone, with 2 seams of coal, of 4 and 12 inches	27
Total	386

We have given a section of one of the principal works of the lately opened part of the country, at HETTON, in the county of Durham, where the shafts are nearly 300 yards deep. This colliery was completed to its present level in 1822, and is a very valuable one. The difficulties encountered from the influx of water, were very great, and for the space of three months, until its flow could be stopped, by *cribbing* or *tubbing*, as it is called,—i. e. fencing the cavity of the shaft by a walling of strong planks,—not less than 3000 gallons, per minute, were pumped up by the engines. The works above ground, in this district, are all on a magnificent scale; railways for the conveyance of the coal to the loading places on the rivers, are frequent; and the mechanical contrivances to assist in filling the colliery vessels, are, in many instances, curious and interesting. The principal shipping from this colliery now takes place at *Seaham*, to which point a railway has been conducted; the distance is only

about 4 miles, but the undertaking was a bold and expensive one, as the work is carried up inclined planes, across valleys, and through passages cut in the solid rock, to an extent scarcely known elsewhere.

In these mines, after *holeing under*, or forming a "bord," and *cutting* or picking away the sides, so as to form a "judd," as it is termed, the mass is brought down by blasting with gunpowder, which shatters the coal into pieces of moderate size. The whole is afterwards raised, and "screened" by passing over sieves of differently sized meshes, in order to separate the coal, according to the size of its fragments, which regulates the price in the market.

The quantity of combustible matter contained in the coal of the northern fields, is much greater than that in an equal portion of the Staffordshire coal, and the situation of the mines in relation to the river, and the nature of the rivers themselves, their depth, rapidity, and volume of water, are such as to give every facility to the transit of this valuable mineral, to the open sea, by which it is transported, to become the great source of supply to the entire eastern and southern coast of England.

This immense mineral tract, like that of Warwickshire, is a *coal country* alone. Beds of ironstone, it is true, are interspersed, but they are too inconsiderable to be worked; so that a market has been wanting for the smaller coal or fine slack, which might have fed the blast engines. The consequence has been the loss of quantities, almost incalculable, by burning on the banks. All that which passed through the last screen, was considered too small for shipping, and was left exposed to

the air. Vast piles thus accumulated, which, at length, by the chemical action of their components, spontaneously caught fire, and could not possibly be extinguished till areas of 10 to 12 acres piled to a great height, have been seen in flames at once, near the town of Newcastle. This waste and inconvenience is now greatly remedied by the establishment of railways, and by the prevalence, in every direction, of steam engines, which consume without difficulty, the hitherto useless heaps.

The occurrence of fatal explosions to an alarming extent, has prevailed in these mines, even to the present day, in spite of all the improvements of modern science. This shows some deficiency. We have no hesitation in declaring that, either by skilful ventilation, or by the use of *safety lamps*, on the most truly improved construction, these catastrophes might be nearly prevented. Their recurrence is evidence of the defective state of our knowledge, or of our humanity; and the groans of the sufferers,—the wailings of the widows and the fatherless, rise in concert to claim from the philosopher, the philanthropist, and the capitalist, the abolition or the palliation of the evil. But neither will the efforts of these be available, unless to their inquiries and their liberal expenditure, be superadded a ceaseless, sedulous attention to the *intellectual* and *moral condition* of the labourers. It is *these* who must be elevated from their degraded state;—advanced in the ranks of reasonable agents;—and enabled to discern their position, and its dangers; to perceive the necessity of overcoming them: and wisely to use all well-arranged means for attaining that most desirable and important end.

Dr. Thompson, about 20 years ago, calculated that the stores of coal in this district, could not be exhausted under 1000 years. It appears to us, however, that his quantities are taken less from modern working, than from averages, including older calculations of consumption; and, reasoning from the rapidity with which new acres of coal-land are opened and cleared in Staffordshire, a different conclusion we think would now be arrived at,—the quantities raised, being to those of 50 or 60 years back, as 30 or 40 to one. It is true, the increased consumption in the southern fields, is greater in proportion, on account of the enormously increased state of the *iron manufacture*; but enough is everywhere used to cause the prudent mind to wish that some more accurate inquiry were made into the actual state of the country's resources.

[*See Conybeare and Phillips's Geology.—The Penny Magazine, &c.*]

TABLES

OF

STRATIFICATION.

We arrive, now, at the last division of our work. This consists of minutely detailed Tables of the stratifications, as they occur in the various districts we have described. These Tables, although they repeat *the contents of the* CHART, will not be without their use in this place. It is the office of the CHART to represent to the eye, the course and the comparative thickness of each measure; —to exhibit strikingly the amazing variety of materials deposited, and, with as much correctness as can be attained, the characteristic colouring of each successive layer. But there may be occasions when references and verifications are desirable, when a large engraved sheet could not be conveniently transported in order to make the desired appeals. In such instances, a manual like the present volume, becomes available, and in one part or other of its varied contents, it must endeavour to yield to the miner or to the inquirer, all the information he seeks, or else its assumption of the title of "GUIDE," is fallacious.

Under these views and impressions, we do not hesitate to render our work, in our apprehension, *complete*, by copying, *entire*, the various Sections which fill our Chart.

I.—TABLE OF THE MEASURES

AT THE

HETTON COLLIERY,

In the County of Durham.

	Yds.	Ft.	In.
Depth from the surface, through the soil, &c.	1	0	0
Sand	2	0	0
Gravel	1	0	0
Limestone Marl	7	0	0
Yellow Limestone	31	0	0
Blue Limestone	15	0	0
Blue Metal	2	0	0
Sandstone	1	0	0
White Metal...	0	1	6
Grey Skimy Metal	1	0	0
Strong Brown Limestone	3	0	0
Blue and Grey Metal	12	0	0
Coal	0	1	6
Grey Metal Stone	1	1	6
Blue Metal	3	0	0
Coal	0	1	6
Grey Metal	5	1	6
Coal	0	1	6
Grey Metal	1	1	6
Coal	0	1	6
Grey Metal Stone	7	0	0
Strong White Post	7	0	0
Coal	0	1	6
Grey Metal Stone	1	0	0
Carried forward...	105	1	6

	Yds.	Ft.	In.
Brought forward...	105	1	6
White Post	1	0	0
Grey Metal	2	0	0
White Post	13	1	6
Grey Metal Stone	1	0	0
Coal	0	1	6
Thill	1	0	0
White Post	1	0	0
Grey Metal	1	0	0
Coal	0	1	0
White Post	3	0	0
Grey Metal Stone	1	0	0
Black and Blue Metal	2	1	6
Coal	0	0	9
Grey Metal Stone	1	0	0
White Post	2	0	0
Grey and White Post	3	0	0
Whin	1	0	0
White Post	1	1	6
Strong White Post	4	1	6
Strong White Post, with Water	10	0	0
Grey and White Post	5	0	0
Grey Metal Stone	3	0	0
Coal	0	1	0
Parting	0	0	9
Coal	0	1	0
Parting	0	0	9
Coal	0	2	3
Carried forward...	166	1	6

	Yds.	Ft.	In.
Brought forward...	166	1	6
Parting	0	1	0
Coal	0	1	6
Thill	0	0	9
Grey Metal Stone	2	1	6
Strong Grey Metal Stone	8	0	0
Black Metal	1	0	0
Ditto Grey Metal	1	0	0
Grey Metal Stone	2	0	0
Strong ditto	2	0	0
Grey Metal	2	1	6
Coal Black Metal	0	0	9
Coal 5 Quarters	1	0	9
Grey Metal	10	0	0
Grey Post	2	0	0
Blue and Grey Metal	8	0	0
Ditto ditto, with Girdles	4	0	0
Main Coal	0	1	0
Parting	0	0	9
Coal	1	0	0
Parting	0	0	9
Grey Post	3	0	0
Black Metal Stone	0	0	9
Blue Metal	3	1	6
Grey Metal Stone	1	0	0
Coal	0	0	9
Strong Grey Metal Stone	1	0	0
Grey and White Post	6	0	0
Carried forward...	228	2	9

	Yds.	Ft.	In.
Brought forward...	228	2	9
Grey Metal	6	0	0
Coal	0	0	9
Parting	0	2	3
Coal Mandling	0	0	9
Grey Metal	1	0	0
Blue Metal	4	0	0
Grey Metal	3	0	0
Blue Metal	2	0	0
Strong Grey Post	2	0	0
Whin	1	1	6
Soft Grey Metal	6	0	0
Low Main Coal	1	0	0
White Post	3	0	0
Whin	1	0	0
Grey Metal	4	0	0
Black and Blue Metal Stone	2	0	0
Splint Coal	0	0	9
Grey Metal	2	0	0
Coal	0	0	9
Thill	2	0	0
Strong Grey Metal	2	0	0
Grey Post	3	0	0
Black Metal	1	1	6
Blue Metal	1	1	6
Strong White Post	8	0	0
Grey Metal	2	0	0
Coal	1	1	6
Parting	0	0	9
Coal, Wallsend Seam	1	0	0
Total...	291	2	9

II.—THE WOMBRIDGE MINES,

Near Wellington, Shropshire.

	Yds.	Ft.	In.
From the Surface, Soil, Top Rock, &c. ...	9	0	0
White Clay	6	0	0
Chance Coal	0	0	9
White Tough Clay	0	2	0
Ash Ball Rock	6	0	0
Rocky Marl	6	0	0
Gritty Rock	2	0	0
Rocky Marl	4	1	0
Pearly Rock	1	2	0
Rock Marl	3	0	0
Gritty Rock	1	1	0
Ash Ball	28	0	0
White Rock	1	0	0
Rocky Marl	3	2	0
White Rock	0	2	0
Tough Soft Clay	0	1	6
Hard Rock	1	1	0
Top Penny Stone Measure	2	2	0
Black Slums	0	1	6
Fungus Coal Rock	12	0	0
Fungus Coal	1	0	0
Poundstone	1	1	0
Foot Coal	0	1	0
Blackstone Measure	1	1	0
Stone Coal	1	1	0
Carried forward...	95	2	9

	Yds.	Ft.	In.
Brought forward...	95	2	9
Tough Poundstone	1	1	0
Gur Coal	0	2	0
White Clunch	1	1	0
Grey Rock	1	1	0
Brick Ironstone Measure	5	1	0
Bind Bass	2	0	0
Bind	2	1	0
Ball Stone	3	0	0
Dun Earth	2	0	0
Bass	0	0	4
Top Coal	1	2	0
Poundstone	0	1	0
Slums	1	1	0
Three Quarter Coal	0	2	0
Double Coal Rock	2	0	0
Double Coal	2	0	0
Dark Poundstone	0	1	6
Yellow Stone Earth	2	0	0
Yard Coal	1	0	0
Dry Clay	0	0	9
Dry Clay	3	0	0
Blue Flat Stone	2	0	0
Pitcher Basses	1	2	0
White Flat Stone	2	0	0
Flint Coal Rock	3	1	0
White Clod Roof	4	1	0
Flint Coal	1	2	0
Carried forward...	145	0	4

	Yds.	Ft.	In.
Brought forward...	145	0	4
Brown Flint	7	0	0
Penny Ironstone Measure	8	0	0
Sulphur Coal...	1	2	0
Bass	0	1	6
Upper Clunch Coal	3	1	0
Upper Clunch	1	0	0
Clunch Coal	0	2	0
Lower Clunch	2	0	0
Two Foot Coal	0	2	0
Linseed Earth	4	0	0
Best Coal	0	2	0
Randle Coal	1	0	0
Bonnock	0	2	0
Clod Coal	1	1	0
Pale Blue Clod	1	1	6
Sand Stone	3	0	0
Little Flint Coal	0	2	0
Little Flint	15	0	0
Total...	197	2	4

Limestone, thickness not known, probably 8 or 10 yards.

III.—MINE AT APEDALE,

Near Newcastle-under-Lyme, Staffordshire,

THE PROPERTY OF R. E. HEATHCOTE, ESQUIRE.

	Yds.	Ft.	In.
From the Surface, Soil and Rock ...	19	0	0
Peacock Coal...	1	2	0
Rock	19	0	0
Spencroft Coal	1	2	0
Rock and Basses	15	0	0
Great Roe Coal	2	0	0
Rock and Basses	19	0	0
Kennell Coal...	2	0	0
Rock and Basses	19	0	0
Little Roe Coal	2	1	0
Black Ironstone in four Beds	20	0	0
Rusty Mine in four Beds	6	0	0
Rusty Mine Coal	3	0	0
Basses	6	0	0
Coal	1	0	0
Rock	11	0	0
Balls	1	0	0
Rock	17	0	0
Chalky Ironstone in eleven Beds... ...	8	0	0
Rock	18	0	0
Ironstone in seven Beds	2	2	0
Rock	2	0	0
Brown Ironstone	1	2	0
Carried forward...	198	0	0

	Yds.	Ft.	In.
Brought forward...	198	0	0
Rock	26	0	0
Brown Mine Stone	2	0	0
Rock and Basses	18	0	0
Thick bond Ironstone	2	2	0
Rock	8	0	0
Ironstone	2	1	0
Rock	110	0	0
Single four Foot Coal	1	2	0
Brown Rock	13	0	0
Single five Foot Coal	1	2	0
Brown Rock	26	0	0
Ragman Coal...	1	0	6
Basses	8	0	0
One Yard to seven Foot Coal	2	2	6
Basses	2	0	0
Hams Coal	1	2	0
Brown Rock	40	0	0
Ten Foot Coal	3	0	0
Brown Rock	19	0	0
Top Two Roe Coal	0	2	0
Basses	36	0	0
Brown Rock	100	0	0
Bowling Alley Coal	1	2	0
Brown Rock	34	0	0
Seven foot Nabbs Coal	1	2	6
Brown Rock	60	0	0
Eight Foot Nabbs Coal...	1	1	0
Carried forward...	722	1	6

	Yds.	Ft.	In.
Brought forward...	722	1	6
Parting	0	0	6
Grey Coal	3	0	0
Total...	725	2	0

IV.—MINE AT WOODSHUT COLLIERY,

Harecastle, near Newcastle-under-Lyme,

THE PROPERTY OF R. E. HEATHCOTE, ESQUIRE.

	Yds.	Ft.	In.
From the Surface, Red Soil	26	2	0
Coal	1	0	0
Basses	7	0	0
Four Foot Coal	1	1	0
Basses	3	0	0
Ragman Coal...	1	0	0
Rock	19	0	0
Rough seven Foot Coal	2	0	6
Basses	35	0	0
Stony eight Foot Coal	1	1	0
Rock and Basses	40	0	0
Ten Foot Coal...	3	0	0
Rock and Basses	24	0	0
Top two Roe Coal	1	0	0
Rock and Basses	18	0	0
Under two Roe Coal	1	0	6
Rock	10	0	0
Stay Coal	1	0	0
Rock	30	0	0
Bowling Alley Coal	1	2	0
Rock and Basses	60	0	0
Seven Foot Nabbs Coal	2	0	0
Rock and Basses	35	0	0
Eight Foot Nabbs Coal	2	0	0
Total...	326	1	0

V.—MINES AT MOSSFIELD COLLIERY,

Near Lane End Potteries.

	Yds.	Ft.	In.
From the Surface, Rock and Red Sand ...	135	0	0
Adderley Coal	1	1	6
Rock and Basses	50	0	0
Little Mine Coal	0	2	10
Basses	7	0	0
Three quarter Coal	0	2	3
Rock	23	0	0
Brick Mine Coal	1	2	0
Rock	17	1	0
Coal	1	0	0
Rock and Basses	23	0	0
Coal	1	1	0
Rock and Basses	26	0	0
Nortin seven Foot Coal...	2	1	0
Basses	13	1	0
Coal	0	2	3
Rock	40	0	0
Holly Lane Coal	1	1	0
Total...	346	0	10

VI.—MINES NEAR WOLVERHAMPTON,

THE PROPERTY OF W. SPARROW, ESQ.

	Yds.	Ft.	In.
From the Surface, Soil, Clay, and Binds ...	10	0	0
Coal	1	0	0
Binds	7	2	0
New Mine Stone	1	1	0
Clunch	4	1	0
Sulphur Coal...	0	2	0
Binds	10	0	0
White Rock	19	2	0
Top New Mine Coal	2	1	3
Fire Clay Parting	1	2	9
Fire Clay Coal	2	0	3
Parting	0	0	9
Coal	1	0	0
Parting	0	1	0
Binds	6	0	0
Poor Robin	1	1	0
Basses	3	0	0
White Ironstone	1	1	0
Bottom Coal	4	0	0
Binds	7	0	0
Balls	1	0	0
Basses	1	1	0
Gubbin	1	0	0
Green Rock	6	2	0
Rock Binds	10	0	0
Blue Flats	0	2	6
Total...	106	0	6

VII.—MINES NEAR BILSTON,

THE PROPERTY OF BENJAMIN BICKLEY, ESQ.

	Yds.	Ft.	In.
From the Surface, Soil, Clay, and Loam ...	12	1	2
Rock Binds	4	1	0
White Coal	1	0	0
Tow	0	2	0
Brazils	1	0	6
Parting	0	0	2
Foot Coal	0	2	6
Hob and Jack	3	1	0
Slips Coal	0	2	0
Stone	1	0	0
Patchels	0	2	0
Sawyer	0	2	6
Slipper	1	0	4
Parting	0	0	4
Humphries	0	2	6
Clay	1	2	0
Gubbin	0	2	9
Table Batt	1	1	3
Clunch	0	1	6
Black Ring	0	1	0
White Clunch	5	0	6
Heathen Coal	0	2	3
Fire Clay	2	0	0
Clunch	1	1	3
Rock Binds	7	0	0
Carried forward...	50	0	6

	Yds.	Ft.	In.
Brought forward...	50	0	6
Rubble Coal	1	1	0
Rock Binds	2	2	0
White Rock	3	1	0
Clunch	1	2	0
White Stone	1	1	0
Dark Clunch	3	1	6
Penny Stone Measure	3	0	0
Sulphur Coal...	1	0	8
Fire Clay	1	1	3
White Clunch	1	1	3
Grey Rock	9	0	0
Binds	2	2	0
White Rock	5	0	0
Top Coal	2	1	0
Parting	0	2	0
Coal	2	0	0
Parting	0	0	10
Coal	0	2	10
Fire Clay	1	2	0
Coal	0	2	0
Getting Rock	0	2	0
Clunch	0	1	6
Basses	2	2	0
Poor Robin	1	0	0
Basses	1	0	0
White Stone	0	2	10
Clunch	0	1	6
Carried forward..	103	1	8

	Yds.	Ft.	In.
Brought forward..	103	1	8
Coal	0	1	6
Parting	0	0	4
Coal	2	0	6
Clunch	0	2	6
Total..	107	0	6

VIII.—MINES AT FREEZLAND,

Near Wolverhampton,

THE PROPERTY OF MESSRS. P. WILLIAMS AND SONS.

	Yds.	Ft.	In.
From the Surface, THROUGH THE THICK COAL	30	2	0
White and Blue Clay	1	2	0
Gubbin	0	2	9
Table Batt	1	1	3
Clunch	0	1	0
Black Ring	0	0	6
Binds	6	0	0
Heathen Coal	0	2	0
Fire Clay	2	0	0
Binds	2	0	0
Rock and Binds	3	0	0
Rubble Coal	1	0	0
Coarse Fire Clay	0	1	0
Brown Rock	2	1	0
Peldon	0	2	0
Binds	1	1	6
New Mine Ironstone	1	0	0
Penny Stone Measure	6	0	0
Sulphur Coal...	1	0	0
Fire Clay	1	0	0
Rock and Rock Binds	24	0	0
Top Coal	1	0	0
Carried forward...	88	2	0

	Yds.	Ft.	In.
Brought forward...	88	2	0
Parting	0	1	0
Coal	1	0	0
Clunch	2	0	0
Fire Clay	1	2	0
Fire Clay, bad	0	1	0
Batt and Coal	0	2	0
Rock, &c.	1	1	6
Brown Basses	2	1	0
Poor Robin Balls and Gubbin	1	0	6
Basses	2	1	0
White Ironstone	0	2	6
Coal	0	1	6
Parting	0	0	4
Coal	1	2	2
Fire Clay	1	1	6
Coal	1	1	0
Fire Clay	0	1	0
Rock	3	0	0
Coal	0	0	4
Clod	2	0	0
Balls and Ironstone	1	1	6
Clunch	6	1	6
Green Rock	6	2	0
Rock and Binds	10	0	0
Blue Flat Ironstone	0	2	6
Total...	138	2	10

IX.—MINES NEAR BILSTON,

THE PROPERTY OF ——— LOXDALE, ESQ.

	Yds.	Ft.	In.
From the Surface, THROUGH THE THICK COAL	28	0	0
Sundry Measures	8	0	0
Heathen Coal	0	1	3
Clunch and Binds	3	0	6
Coal	0	0	9
Black Batt	0	2	0
Binds	1	1	0
Peldon and Free Stone...	1	2	3
Ironstone	0	2	0
Ditto	0	1	0
Clunch	2	1	0
Coal	0	1	2
Fire Clay	0	2	6
Binds	13	0	6
Peldon	0	1	0
Binds	12	0	0
Grey Rock	0	2	0
Coal	1	2	0
Parting	0	1	3
Coal	1	1	4
Parting	0	0	4
Coal	0	2	0
Fire Clay	2	1	4
Carried forward...	81	0	2

	Yds.	Ft.	In.
Brought forward..	81	0	2
Black Ground	0	1	3
Coal	0	1	5
Black Ground	1	0	4
Clunch	0	2	0
Ironstone	1	0	0
Coal	0	1	6
Parting	0	0	5
Coal	1	0	0
Fire Clay	0	2	3
Clunch	0	1	9
Rock	0	0	6
Ironstone	0	2	3
Binds	2	0	9
Getting Rock...	0	0	8
Fire Clay	0	2	0
Clunch	2	0	0
Rock	0	0	6
Gubbin	0	1	3
Gritty Rock	1	0	0
Ironstone	0	0	6
Clunch	0	2	6
Rock, &c.	2	2	0
Clunch	1	1	0
Coal	0	2	7
Clunch	0	2	6
Batt and Coal	2	0	8
Clay	0	0	4
Ironstone	1	0	11
Total..	105	2	0

X.—MINES NEAR WALSALL,

THE PROPERTY OF THE RIGHT HON. LORD LICHFIELD.

	Yds.	Ft.	In.
From the Surface, Soil and Clay ...	1	0	0
Rock	8	2	0
Coal	3	0	10
Clunch	3	0	2
Clunch	4	2	0
Clunch	7	1	0
Coal	0	1	11
Fire Clay	0	1	6
Clunch	0	1	7
Coal	1	2	11
Clunch	1	2	0
Rock	4	0	0
Coal Batt	0	1	6
Clunch	0	2	0
Clunch	1	1	5
Gubbin Stone	0	0	4
Clunch	0	1	0
Heathen Coal	0	1	2
Clunch	7	1	6
Clunch	0	1	0
Sulphur Coal...	0	1	9
Clunch	1	0	2
Ironstone	0	0	6
Measures	0	2	1
Carried forward...	51	0	4

	Yds.	Ft.	In.
Brought forward...	51	0	4
Ironstone	0	0	4
Measures	0	0	4
Ironstone	0	0	6
Measures	1	0	0
Ironstone	0	0	3
Measures	0	2	2
Ironstone	0	0	8
Measures	0	2	0
Ironstone	0	0	3
Prickin	0	0	3
Rock	2	0	0
Clunch	3	1	11
Ironstone	0	0	5
Clunch	1	0	6
Ironstone	0	0	2
Clunch	1	1	0
Ironstone	0	0	3
Clunch	0	1	8
Ironstone	0	0	3
Clunch	1	0	0
Coal	0	1	6
Clunch	3	1	6
Rock	3	0	3
Parting	0	0	2
Grey Rock	7	1	4
Coal	1	0	3
Fire Clay	0	1	5
Carried forward...	80	1	8

	Yds.	Ft.	In.
Brought forward...	80	1	8
Rock	0	0	8
Clunch	1	0	0
Rock	11	2	6
Coal	1	2	0
Black Batt	1	1	7
Fire Clay	0	2	0
Rock Binds	4	1	0
Clunch	0	2	0
Coal	0	2	1
Fire Clay	0	0	7
Coal	0	1	2
Fire Clay	0	1	4
Clunch	3	0	4
Rock Binds	3	1	0
Peldon	0	2	0
Rock	0	2	0
Binds	3	0	2
Clunch	1	0	0
Ironstone	0	0	3
Clunch	0	0	8
Ironstone	0	0	3
Clunch	0	1	6
Ironstone	0	0	3
Clunch	1	1	0
Ironstone	0	0	6
Clunch	0	2	3
Green Rock	11	0	5
Carried forward..	130	1	2

				Yds.	Ft.	In.
			Brought forward...	130	1	2
Coal	..	..	... ...	0	2	1
Parting	...	...	... ...	0	0	5
Coal	...	...	... ...	1	1	8
			Total...	132	2	4

XI.—MINES AT THE DEEPFIELD,

Near Bilston,

THE PROPERTY OF MESSRS. SMITH.

	Yds.	Ft.	In.
From the Surface, Soil, Clay, and Binds ...	60	0	0
Brooch Coal	1	0	9
Blue Binds	30	0	0
Flying Reed	1	1	0
Blue Binds	18	0	0
Rock	10	0	0
White Coal	1	0	0
Tow	0	2	0
Brazil	1	0	6
Parting	0	0	2
Foot Coal	0	2	6
Batt	0	2	0
Slips Coal	0	2	0
Stone Coal	1	0	0
Patchels	0	2	0
Sawyer	0	2	6
Slipper	1	0	4
Humphries	0	2	6
Gubbin Measures	1	1	0
Clunch	1	1	0
Batt	1	1	0
Strong Ground	3	0	0
Heathen Coal	1	0	0
Carried forward...	138	0	3

	Yds.	Ft.	In.
Brought forward...	138	0	3
Basses	17	0	0
New Mine Ironstone	1	0	6
Binds	6	0	0
Sulphur Coal...	1	0	0
Fire Clay	1	2	0
Binds	13	0	0
New Mine Coal	2	0	0
Parting	1	1	0
Fire Clay Coal	1	2	0
Parting	0	1	8
Coal	0	2	0
Parting	0	2	0
Coal	0	1	6
Getting Rock	1	2	0
Poor Robin	1	0	3
White Stone	1	0	0
Balls and Gubbin	1	1	9
Fire Clay	3	1	6
Bottom Coal	2	0	0
Parting	0	2	6
Coal	1	0	6
Rock	3	0	0
Clod	2	0	0
Ironstone Balls	1	1	6
Clunch	6	1	6
Green Rock	6	2	0
Clunch and Rock Binds	10	0	0
Carried forward..	227	2	6

	Yds.	Ft.	In.
Brought forward..	227	2	5
Blue Flats Ironstone	0	2	6
Blue Rocky Clunch	50	0	0
Clunch	5	0	0
Limestone	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Ditto	1	0	0
Total...	293	1	11

XII.—MINES AT THE MOAT COLLIERY,

In the Parish of Tipton, near Dudley.

	Yds.	Ft.	In.
From the Surface, Soil and Clay	2	0	0
Brown Rock	6	2	8
Blue Binds	40	0	0
Fire Clay	1	2	0
Brown Rock	1	2	0
Black Ring	0	1	0
Brown Clay	1	0	0
Rock	2	0	6
Brown Clay	0	2	0
Rock	1	0	0
Black Ring	0	0	6
Binds	1	0	0
Black Ring	0	1	0
Binds	2	0	0
Coal	0	0	2
Fire Clay	0	2	4
Rock	1	0	0
Binds	2	2	0
Batt	0	2	0
Coal	0	2	0
Fire Clay	0	2	0
Black Rock	1	2	0
Clunch	0	1	0
Rock	0	1	0
Carried forward..	69	2	2

	Yds.	Ft.	In.
Brought forward...	69	2	2
Blue Binds	2	2	0
Brooch Coal	1	0	6
Black Batt	0	1	0
Black Ground	1	2	0
Batt	0	0	6
Coal	0	0	6
Black Ground	1	1	6
Blue Binds	12	1	6
Blue Binds	6	0	0
White Rock	6	0	0
Binds	18	0	0
Rock	1	0	0
Grey Binds	1	0	0
Rock and Peldon	4	0	0
Binds	1	0	0
Rock	0	1	0
Binds	0	2	0
Blue Binds	4	0	0
Black Batt	1	0	6
Roves Coal	1	1	0
Parting	0	0	2
Slipper	0	2	0
Parting	0	0	3
White Coal	1	0	3
Tow Coal	1	0	0
Brazils	0	1	6
Foot Coal	0	1	6
Carried forward..	138	0	10

	Yds.	Ft.	In.
Brought forward...	138	0	10
Parting	0	0	6
Slips Coal	1	0	0
Batt and Stone	0	0	7
Stone Coal	1	1	0
Slipper and Sawyer	1	1	0
Parting	0	0	3
Benches	0	2	0
Blacktery	0	1	9
Whitery	1	0	0
Gubbin	1	0	0
Table Batt	1	1	0
Loam and Stone	0	2	6
Heathen Coal	1	0	4
Fire Clay	0	2	0
Binds and Fire Clay	3	0	0
Peldon	0	2	0
White Rock	3	2	6
Rubble Coal	1	1	6
White Rock	2	0	0
Peldon	0	2	6
Grey Rock and Binds	3	0	0
New Mine Ironstone	2	1	0
Dark Ground	6	2	0
Sulphur Coal	1	0	0
Parting	0	1	3
Coal	1	1	9
Grey and White Rock	5	0	0
Carried forward..	181	1	3

	Yds.	Ft.	In.
Brought forward...	181	1	3
Black Batt	0	1	0
New Mine Coal	1	0	3
Parting	0	0	3
Coal	0	2	0
Fire Clay	0	2	6
Coal	0	0	3
Fire Clay	1	2	0
Coal	0	0	10
Black Batt	0	1	8
White Grey Rock	3	0	5
Grey Rock	0	1	11
White Rock	2	0	10
Black Batt	0	1	3
Bottom Coal	0	2	0
Parting	0	1	3
Coal	1	1	5
Parting	0	0	7
Coal	0	0	9
Parting	0	0	6
Coal	0	1	0
Fire Clay Rock	2	0	10
Black Ground	1	1	0
Fire Clay	1	2	0
Binds and Ironstone	2	2	0
Fire Clay	0	1	6
Batt	0	1	0
Fire Clay	0	2	6
Carried forward...	206	1	9

	Yds.	Ft.	In.
Brought forward...	206	1	9
Batt	0	0	6
Fire Clay	0	2	0
Black and White Rock	2	0	0
Green Rock...	11	1	0
Coal	0	0	10
Batt	1	0	2
White Rock	10	0	0
Blue Rock and Binds...	37	1	6
Parting	0	0	2
Binds	5	1	10
Stone and Binds	57	0	11½
Total...	332	1	8½

XIII.—MINES AT COSELEY,

In the Parish of Sedgley.

	Yds.	Ft.	In.
Depth FROM THE HEATHEN COAL, Fire Clay and Ball Measures	2	2	0
Rock	0	1	0
Peldon	0	1	6
Rock	0	2	0
Coal and Batt	1	0	2
Ironstone Binds	1	2	3
Ditto	1	2	6
Penny Measures	2	0	0
Sulphur Coal...	0	2	0
Fire Clay	0	2	6
Grey Rock	6	0	0
Coal and Batt	1	2	0
Fire Clay	0	2	6
Rock	6	0	6
Rock	2	0	0
Batt and Coal	0	2	3
Clunch	1	0	0
Coal	0	2	4
Clunch	0	1	10
Coal	0	1	0
Fire Clay	0	2	6
Rock	1	2	6
Total...	35	0	4

XIV.—MINES IN THE FOXYARDS,

Near Dudley,

THE PROPERTY OF THE RIGHT HON. LORD DUDLEY.

	Yds.	Ft.	In.
Depth FROM THE THICK COAL, Batt, &c. ...	1	1	3
Clunch	0	2	0
Gubbin	1	1	0
Table Batt	1	1	0
Coal	0	0	8
Batt	1	1	0
Heathen Coal	1	1	0
Parting	0	0	6
Coal	0	1	2
Batt	0	1	3
Coal	0	0	7
Batt	0	2	0
Parting	0	0	6
Peldon	0	1	6
Rock	0	1	0
Peldon	0	1	4
Rock	0	1	8
Binds	2	1	0
New Mine	0	0	5
Clunch	0	1	6
Ironstone	0	0	1
Clunch	0	1	3
Ironstone	0	0	3
Carried forward...	14	2	11

	Yds.	Ft.	In.
Brought forward...	14	2	11
Clunch	1	0	3
Ironstone	0	0	3
Clunch	4	0	0
Penny Measures	4	1	0
Sulphur Coal	0	2	3
Fire Clay	0	2	4
Coal	0	2	4
Parting	0	0	3
Coal	0	1	6
Batt	0	1	0
Fire Clay	1	0	0
Binds	1	0	7
Rock	2	0	0
Coal	0	1	10
Fire Clay	0	1	7
Batt	0	1	1
Balls	1	0	6
Clunch	0	2	7
Coal	0	2	7
Parting	0	1	9
Coal	0	1	4
Fire Clay	1	0	0
Clunch	0	2	0
Batt	0	2	0
Total..	39	1	11

XV.—MINES AT HIGHFIELDS,

Near Bilston,

THE PROPERTY OF MESSRS. TARRATT AND CO.

	Yds.	Ft.	In.
Depth from the Surface, Soil, Sand, and Binds	30	0	0
Brooch Coal	1	0	9
Binds, &c.	30	0	0
Flying Reed Coal	1	0	6
Sundries	18	0	0
Sundries	10	0	0
Sundries	29	2	11
Rock	10	0	4
White Coal	1	0	0
Tow	0	2	0
Brazils	1	0	6
Parting	0	0	2
Foot Coal	0	2	6
Batt	0	2	0
Slips Coal	0	2	0
Stone Coal	1	0	0
Patchels	0	2	0
Sawyer	0	2	6
Slipper	1	0	4
Humphries	0	2	6
Gubbin	1	0	3
Sundries	9	0	0
Carried forward...	150	0	3

	Yds.	Ft.	In.
Brought forward..	150	0	3
Heathen Coal	0	2	6
Dark Clunch...	3	1	0
Penny Coal	0	2	0
Brown Rock	5	2	9
New Mine	1	0	7
Clunch	4	1	6
Sulphur Coal...	0	2	0
Rock, &c.	11	1	2
Peldon	3	1	6
Rock	7	1	0
Top Coal	2	0	0
Parting	0	2	10
Coal	1	2	0
Brown Rock	2	0	0
Coal	0	2	0
Fire Clay	2	1	4
Coal	0	2	0
Getting Rock	0	2	4
Balls Ironstone	0	1	0
Batt	1	1	0
Poor Robin	0	2	6
Coal	1	1	9
Rock	3	0	0
Total...	207	2	0

XVI.—MINES AT WEDNESBURY,

THE PROPERTY OF MESSRS. LLOYD, FOSTER, AND CO.

	Yds.	Ft.	In.
Depth from the Surface, Soil and Clay ...	2	2	0
Binds	2	0	0
Binds	1	1	6
Black Batt	1	1	3
Ditto ditto	0	2	0
Rock	5	0	0
New Mine Ironstone	1	0	0
Chester	0	1	6
Meadry	0	2	9
Roves	0	1	6
Ironstone	0	1	9
Sundry Measures	11	0	0
Coal	1	0	4
Clunch	1	0	4
Coal	1	1	3
Parting	0	0	2
Coal	2	0	10
Fire Clay	1	2	6
Coal	1	2	8
Fire Clay	2	1	7
Rock, &c.	4	2	6
Coal	0	2	5
Batt	0	1	4
Coal	0	2	3
Carried forward..	46	2	5

	Yds.	Ft.	In.
Brought forward..	46	2	5
Clunch	1	2	0
Ironstone	1	0	0
Clunch	3	0	0
Ironstone	1	1	3
Clunch	0	2	9
Batt and Coal	1	1	6
Coal	0	2	6
Fire Clay	1	0	6
Batt and Coal	1	0	9
Binds	1	0	0
Coal	0	1	4
Bare Stone	0	0	7
Binds	1	0	0
Ironstone	1	1	4
Binds	2	0	0
Total...	65	1	11

XVII.—MINES AT COSELEY,

THE PROPERTY OF H. B. WHITEHOUSE, ESQ.

	Yds.	Ft.	In.
Depth from Surface, THROUGH THE THICK COAL, HEATHEN COAL, AND FIRE CLAY..	77	1	8
Clay and Balls of Ironstone . ..	3	0	0
Rock	2	0	0
Peldon	2	0	0
Rock	3	1	6
Coal and Batt	1	0	6
Clunch, with Binds of Ironstone ..	5	1	6
New Mine Ironstone	1	1	0
Penny Measures	3	1	0
Sulphur Coal..	0	2	7
Fire Clay	0	1	6
Rock	9	0	6
New Mine Coal	1	1	6
Fire Clay	0	2	6
Rock	5	0	5
Fire Clay Coal and Parting	1	2	8
Fire Clay	1	2	0
Coal and Batt	0	2	0
Rock	2	0	6
Ironstone Measures	1	1	6
Binds	1	2	6
Bottom Coal	2	0	8
Carried forward...	129	1	0

	Yds.	Ft.	In.
Brought forward...	129	1	0
Parting	0	1	1
Coal	0	2	3
Rock	2	2	0
Ball and Ironstone	2	1	8
Parting	0	2	0
Rock	0	0	9
Dark Strata	0	2	6
Fire Clay	0	2	0
Batt	1	2	6
Rock	0	2	0
Fire Clay	1	0	0
Peldon	0	1	6
Binds	1	1	0
Binds	1	1	0
Clunch	1	1	6
Batt	0	1	0
Fire Clay	1	0	7
Rock	9	2	6
Balls, with Ironstone	2	1	0
Total...	159	2	10

XVIII.—MINES AT WEST BROMWICH,

Near the Swan Inn,

THE PROPERTY OF MRS. HOLLOWAY.

	Yds.	Ft.	In.
Depth from the Surface, Soil and Clay ...	1	2	0
Loam	1	1	0
Red Sand	17	0	0
Red Clay	4	0	0
Sand	5	0	0
Fire Clay	6	0	0
Blue Clunch	10	0	0
Coal	0	2	0
Blue Clunch	6	0	0
Brooch Coal	1	0	10
Black Ground	7	0	0
Fast Ground	10	0	0
White Rock	20	0	0
Rock Binds	9	0	0
Rock Binds	12	0	0
Roves Coal	0	2	0
Slipper Coal	1	0	0
White Coal	1	0	0
Tow Coal	0	2	0
Brazils	1	0	0
Foot Coal	0	2	6
Ditto ditto	0	2	6
Carried forward..	116	2	10

	Yds.	Ft.	In.
Brought forward...	116	2	10
Stone Coal	1	1	0
Slipper and Sawyer	1	1	0
Benches	0	2	3
Total...	120	1	1

XIX.—THE RESULT

OF A

LABORIOUS EXPERIMENT IN BORING,

At Smethwick, in the County of Stafford,

ON LAND THE PROPERTY OF MR. JAMES HORTON.

	Yds.	Ft.	In.
From the Surface, Soil and Marl... ...	3	2	0
Red Sand	4	1	0
Loamy Sand	1	1	6
Marl	3	1	0
Red Ground	7	0	0
Loamy Sand	1	1	0
Red Ground	1	2	3
Red Sand	2	1	10
Red Sand Rock	16	0	0
Red Sand	2	1	0
Red Sand	28	1	0
Red Ground	1	1	0
Red Sand	4	0	0
Peldon	1	1	6
Parting	0	2	6
Peldon	8	0	0
Parting	0	2	6
Peldon	2	0	0
Red Ground	16	0	0
Red Rock	1	1	4
Carried forward..	108	0	5

	Yds.	Ft.	In.
Brought forward...	108	0	5
Red Ground	4	2	6
Red Rock	1	0	6
Red Ground	4	2	6
Red Sand	1	2	0
Red Ground	0	2	6
Red Ground	4	2	0
Red Ground	0	2	0
Strong ditto	0	2	4
Red Ground	2	1	0
Rock	0	0	6
Red Ground	1	1	0
Rock	0	0	10
Red Ground	0	1	0
Ditto ditto	0	1	6
Red Rock	3	0	6
Red Ground	1	1	3
Rock	0	1	4
Red Ground	0	2	3
Red Rock	1	2	0
Red Ground	0	1	6
Red Rock	1	0	0
Red Ground	1	1	6
Red Rock	2	2	0
Red Ground	0	2	8
Red Ground	1	0	4
Rock	0	0	2
Red Ground	0	2	6
Carried forward...	148	1	7

	Yds.	Ft.	In.
Brought forward...	148	1	7
Rock	1	0	6
Parting	0	0	6
Red Rock	2	2	0
Red Ground	1	2	6
Red Rock	1	2	6
Red Ground	1	0	6
Red Rock	0	1	0
Red Ground	1	2	9
Parting	0	0	6
Red Ground	1	0	0
Ditto ditto	0	2	0
Grey Rock	1	1	0
Parting	0	1	0
Red Rock	0	2	6
Ditto ditto	0	0	9
Ditto ditto	1	0	0
Grey Rock	5	0	3
Red Ground	1	0	6
Grey Rock	4	0	9
Red Ground	0	1	6
Rock	0	0	6
Red Ground	0	0	10
Rock	0	0	6
Red Ground	0	2	0
Red Rock	3	0	3
Parting	0	1	0
Rock	0	1	4
Carried forward...	181	1	0

	Yds.	Ft.	In.
Brought forward..	181	1	0
Parting	0	0	6
Grey Rock	3	0	2
Parting	0	0	9
Grey Rock	1	0	9
Parting	0	0	6
Red Rock	1	1	5
Total...	187	2	1

XX.—THE HAWKESBURY MINES,

At Bedworth, in the County of Warwick,

THE PROPERTY OF GEORGE WHEELDON, ESQUIRE.

	Yds.	Ft.	In.
From the Surface, Soil, Clay, and Marl ...	13	0	0
Sand Rock	13	0	0
Blue Binds	9	0	0
Sand Rock	13	0	0
Blue Binds	9	0	0
Rock	17	0	0
Earth	7	0	0
Rock	7	0	0
Binds, with Ironstone	13	0	0
Rock	11	0	0
Binds, with Ironstone	19	0	0
Rock	4	0	0
Binds	7	0	0
Rock	5	0	0
Binds	6	0	0
Rock	4	0	0
Binds	7	0	0
Rock	4	0	0
Binds	5	0	0
Two Yard Coal	1	2	6
Rider Coal	1	1	0
Carried forward..	176	0	6

	Yds.	Ft.	In.
Brought forward...	176	0	6
Parting	0	0	9
Ell Coal	1	2	6
Slate Coal	2	1	0
Total...	180	1	9

SHUT END MINES.

THE PROPERTY OF JAMES FOSTER, Esq.

Engine Pit.

	Yds.	Ft.	In.
Sand and Clay	4	0	0
Fire Clay and Clunch	2	0	0
Rock	3	1	0
Blue Clunch	3	0	0
Sulphur Coal...	0	0	3
Fire Clay	1	0	0
Blue Clunch	4	2	0
Dark ditto	1	1	0
Grey Rock	2	2	0
Rock and Parting	7	0	0
Brown Clunch	1	2	0
Dark ditto	0	1	0
Brown ditto	3	0	0
Clunch and Fire Clay	1	2	0
White Rock	1	1	0
Dark Clunch...	0	2	0
Clunch and Fire Clay	2	1	0
Mixed Clunch	1	1	0
Blue ditto	1	1	0
Clunch and Fire Clay	3	1	0
Sharp Rock	0	2	6
Brown Clunch	0	1	6
Rock	2	2	0
Carried forward...	50	0	3

	Yds.	Ft.	In.
Brought forward...	50	0	3
Blue Clunch	0	1	6
Dark Rock	1	1	0
Clunch	2	0	6
Little Coal	1	0	0
Brown Clunch and Fire Clay	2	2	0
Dark ditto	0	1	0
Brown Fire Clay	1	0	0
Clunch	6	0	0
Blue ditto	1	2	0
Coal and Batt	0	1	9
Brooch Coal	1	1	0
Batt and Binds	2	1	0
Herring Coal and Parting	0	1	7
Batt on the Pins	0	1	4
Pin Measures	1	1	6
Dark Penny Earth	6	2	5
Blue Clunch, &c.	1	1	0
Rock Binds	1	2	0
Ditto	9	0	0
Rock and Peldon	7	0	0
Shooter's four Measures	2	0	8
Hard Earth	3	2	0
Flying Reed Coal	1	1	0
White Coal	1	0	1
Floors and Tow Coal	1	1	8
Brazils	0	1	8
Fine Coal and Veins	1	1	8
Carried forward...	111	0	7

	Yds.	Ft.	In.
Brought forward...	111	0	7
Parting	0	0	3
Stone Coal	1	0	0
Patchels and Sawyer	1	0	0
Slipper	1	0	0
Rib Coal	0	2	0
Total...	114	2	10

No. 5 PIT,

At the same Place, viz.

	Yds.	Ft.	In.
Clay	0	2	0
Rock	1	0	6
Shady Rock	2	0	0
Soft Earth	1	1	0
Strong Rock	2	0	6
Ditto ditto	6	0	0
Rock Binds	2	0	0
Strong Rock	3	0	0
Rock Binds	0	2	0
Rock and Peldon	2	0	0
Clunch	1	1	6
Mingled Ground	3	2	0
Rock and Peldon	2	0	0
Soft Earth	1	0	0
Strong Binds...	3	1	6
Rock	0	2	6
Fire Clay	0	1	6
Coal	0	1	6
Fire Clay	1	1	0
Strong Rock and Peldon	2	0	0
Binds	3	0	0
Rock	1	2	0
Dark Strong Clunch	3	1	0
Strong Binds...	3	0	0
Carried forward...	48	2	6

	Yds.	Ft.	In.
Brought forward...	48	2	6
Mint Measures	3	1	0
Pebble Rock	1	1	0
Strong Clunch	1	2	0
Mint Ground...	0	2	0
Shady Ground	0	2	0
Strong Mixed ditto	6	0	0
Rock and Peldon	3	1	0
Dark Shady Ground	2	1	6
Strong Mixed Measures	8	2	0
Rock	4	2	6
Strong Clunch	2	0	6
Little Coal and Batt	0	1	6
Strong Fire Clay	1	0	0
Batty Rock	1	1	0
Strong Clunch and Binds	4	2	0
Rock	1	2	6
Mild Clunch	1	0	6
Brooch Coal	1	0	9
Dark Strong Clunch	2	1	0
Coal and Batt	1	0	0
Perin Ironstone Measures	1	0	0
Penny Earth Measures	5	1	0
Strong Clunch	6	0	0
Peldon and Rock	4	2	0
Rock Binds	3	0	0
Strong Clunch	5	1	3
Broad Heath...	1	2	6
Carried forward...	126	1	0

	Yds.	Ft.	In.
Brought forward...	126	1	0
Cats Heath	0	2	6
Black Batt	0	1	6
Flying Reed Coal	1	1	0
Soft Shady Parting	3	1	6
White Coal	1	0	1
Floors and Tow Coal	1	1	8
Brazils	0	1	8
Fine Coal and Veins	1	1	8
Parting	0	0	3
Stone Coal	1	0	0
Patchels and Sawyer	1	0	0
Slipper	1	0	0
Rit Coal	0	2	0
Black Batt	0	1	6
Black and Whitery	1	0	0
Medree and Gubbin Roof	1	0	3
Gubbin Ironstone	1	0	0
Black Batt and Rubble...	0	2	0
Heathen Coal, Top	1	0	2
Ditto ditto, Bottom	0	2	6
Rock and Binds	4	2	11
Ironstone	0	0	3
Clod	1	0	6
Ironstone	0	0	6
Total. .	153	1	5

ERRATA.

In Page 53—Third line from the bottom, for £3 1s. 7d. read £3 1s. 8d.—and in the seventh line, for £2 9s. 7d. read £2 9s. 8d.

——— 57—Eleventh line from the bottom, for £1078 1s. 6d. read £1041 17s. 2d.

——— 59—Eighth line from the top, for 2 feet 3 inches to 3 feet 4 inches, read 1 yard to 5 feet 8 inches.

——— 63—Fifth line from the bottom, instead of Coals at 1s. 8d. £3 15s. 0d. read Coals at 1s. 10½d. £4 4s. 4½d.—and the total, £5 8s. 4½d. instead of £4 19s. 0d.

——— 70—Third line from the bottom, for 3 feet thick, read 3 feet 6 inches.

——— 72—For the total £1 19s. 6d. read £1 19s. 4d.

——— 118—Lines 17 and 19, instead of foot, read yard.

——— 120—Line 5, instead of foot, read yard.

——— 121—Third line from the bottom, for two, read four; in fourth line, for 15, read 14; and in fifth line, for foot, read yard.

——— 122—Line 15, for 1 foot 5 inches, read 1 yard 9 inches.

——— 129—For the total 52,724, at foot of page, read 53,724.

——— 130—For 43 T. 4 C. 4 Q. third line from the bottom, read 43 T. 4 C. 3 Q.; and for 1 T. 4 C. 3 Q. at foot of page, read 1 T. 4 C. 2 Q.

——— 141—In the last column, for total or cost price, read total cost and profit.

Radclyffes and Co. 3, Peck-lane, Birmingham.